

THE *Adams 6. 68. 2*  
**Advancement**  
OF THE  
**Art of Navigation,**  
In TWO PARTS.

The First, Shewing by a New Canon of  
SINES, TANGENTS, and SECANTS,  
how to Resolve all Cases of Right-lined Triangles, only  
by looking into the Tables, without any Calculation.

Particularly applied to all the three kinds of Sailing;

*VIZ.* { By the PLAIN-CHART.  
By *MERCATER'S* CHART.  
By a GREAT CIRCLE.

And to the Art of *SURVEYING*.

**The Second Part.**

Shewing several Observations, for the better ordering the *Log-*  
*line*, and for the more exact and ready measuring, not only  
Minutes, but Seconds of Time; with some New Experiments  
for the more Constant finding of a Ships Way.

The Second Edition Corrected by the Author,  
*HENRY PHILLIPS.*

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95;175

## To the Reader :

The Ingenious and Free-hearted SEA-MAN.

**I** Have made somewhat a Bold Adventure, both upon your Art, and for your Art, but yet I hope to come off well enough in both : For as I doubt not your Pardon for the one ; so I am sure it is your Concernment to be the chiefest Party to promote the other. And though I have ( perhaps somewhat too rashly ) given the On-set, yet it was not in Confidence of my own Skill or Power to effect it, but only to give you an Alarm, and present you with a sure and certain way for the Accomplishment of ( that which I hope you all heartily desire ) the Advancement of your Noble Art of Navigation.

I will not charge your Art with many Errours, they being long since corrected by a Skilful Hand : but yet none that have made any Progress into this Art, but shall find and confess, that it wants much of its desired Perfection. For the Accomplishment whereof, I am sure there is no better way than this I have Prescribed, and which by your Joynt-Endeavours might be easily effected.

Amongst the rest, there are two things which will chiefly conduce to this Purpose. The One is, to procure a good Method of the whole Art of Navigation to be Published and Establisht. The Other is, that you would communicate your Observations and Experiments, which would much help those who shall undertake the Work, and is the only means to bring the Art to Perfection.

For the first of these I have done something already in my Geometrical Seaman, which hath found better Acceptance from you than I expected ; and that hath incouraged me here to present you with another piece thereof, being somewhat of a higher nature than the other. For as that performed things

## To the Reader.

by Geometry in a more true and exact way than formerly was known ; this performs the same things much more exactly by Numbers, and yet without the trouble of Calculation. For here all your Work is performed by New Tables, which I have Calculated for this Purpose ; which being as it were a large Quadrat or Traverse-Table, all your Numbers here are cast up to your hand ; so that the Work will be as readily performed hereby as by any little Instrument, but far more exactly, and with less danger of mistaking the Numbers.

Somewhat of this nature hath been done already by Mr. Norwood, in his Seaman's Practice : but whereas he only makes use of the Table of Sines, I have here shewed you the use also of the Tangents and Secants, which are both of great use, especially the Secants, these being indeed the chief Subject of this Book. And as he shews how to keep the Account of a Ship's Way by the Table of Sines, after the manner of the Plain Chart ; so by these Secants I shall shew you how to keep your Account in any Latitude, according to the True Chart, and that without any Calculation, or without the help of Meridional Parts, much better than with them. This, as it is a thing of great Use and Service, so ( I think I may say ) I am the first that ever thought of this way ; and as it was some content and pleasure to me in the inventing thereof, so I hope it will be much more useful and profitable to you in the using thereof.

Besides, I have applied these Tables of Sines, Tangents, and Secants in such a general way, first, to the Doctrine of Plain Triangles, and then particularly to many other Conclusions, that you may almost apply them to any purpose, either in Sailing or Surveying, with much Ease and Expedition.

The Second Part of this Book I intended but as a Part, or an Appendix to the other. In this, the Subject handled, is about the way of finding the true Motion of a Ship, a thing as needful as the former, or any other in the Art of Navigation. How I have acquitted my self herein, Time and Experience will better manifest : for many of these Conclusions are but proposed for your Tryal and Approbation : and yet I doubt not but you will find them very Practicall and Profitable towards the Advancement of this Admirable and Profitable Art of Navigation, which is, and shall be the Joy and Delight of

Your Philo-Nauticus,

HENRY PHILLIPS.

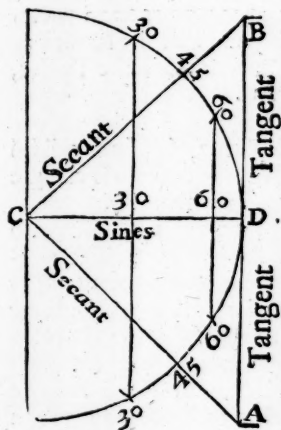
# The Sea-Mans CANON of TRIANGLES.

## CHAP. I.

*Shewing the Demonstration, and general use of these Tables.*

**I** Shall not here trouble my self or you with the definition of those common terms, viz. Arches, Lines, Parallels, Perpendiculars, Angles, either right, oblique, obtuse, or acute; which must needs be known to you already, if you have made any entrance into these Arts; but yet it will not be amiss to demonstrate unto you what these terms Sines, Tangents and Secants are, and how they shew the proportion between a strait Line, and the Arch of a Circle, making up alwayes a right lined right angled Triangle: which this figure will demonstrate to you, better then many words can define and exprefs,

The demonstration of the nature of Sines, Tangents and Secants.



The Sines you may see are the parts of the Radius, or semidiameter  $DC$ , divided unequally according to their proportion to the degrees or parts of the Arches of the Circle, 30, 60, or the like.

The Tangents are the perpendicular lines either erected or let fall at the end of the Radius, or semidiameter of any circle. Thus  $DB$  upward, or  $DA$  downward, is the Tangent of 45 degrees to the Radius  $CD$ .

The intent of the Tables of Sines, Tangents and Secants. The Secants are the sloap Lines  $CB$  or  $CA$ , which joyn the said Radius and Tangents together, making them a Triangle. And this is all the intent of the Tables of Sines, Tangents and Secants, to give the true length of these Lines to any Arch of a Circle desired.

The defect of the ordinary Tables of Sines, Tangents and Secants. And this they would perform admirable well, if the Radius or length of the Line  $CD$  would fall out to be alwayes one and the same, equal to the Radius of the Tables, or any number that hath a visible proportion thereunto, as 100, 1000, 10000, 100000, or the like; for then the Tables without farther trouble, would shew you the exact length of your desired Line, according to your Radius and Angle given, without any trouble, but only cutting off a Figure, or two, or three, from the end thereof.

The remedy which though most exact yet is very troublesome. But because this very seldom happens, therefore for the most part men are forced to find out their desired Numbers, by the proportion which they have to these numbers in the Table; making sometimes one of those Lines stand for the Radius, and sometimes another: For any of the three Lines may be made to stand for the Radius, and the other two Lines will be either Sines, Tangents or Secants thereto, and the proportion will alwayes hold,

As the Radius of your Table, 1000, 10000, or 100000 parts,  
To the length of the Line which you make the Radius;  
So is the Sine Tangent or Secant of any Angle in the Tables,  
To the length of the Line required.

And thus by the Golden Rule of Three, (as some call it) or the Rule of Proportion, some of the parts of a Triangle being known, the other may be found out thereby.

But these operations, as they are unknown to some, so they are sometimes troublesome to those who are best skilled in *Arithmetick*, especially when the Radius of the Tables is larger then it need be; and therefore some for their ease herein make use of the Tables of Artificial Numbers or Logarithms. But though the Logarithms are of very good use in Spherical Triangles, where both the sides, and the Angles are measured by the Arches of a Circle; yet in plain Triangles you may as well, or better perform this, by the Logarithms of the Sines, Tangents and Secants, as by the natural

natural Numbers : For while you look out the Logarithm of your sides (which you need not do, if you work by natural Numbers) you may as soon resolve your Angle, by one Multiplication or Addition, if the Radius of your Tables be not too large, which in most of these questions need not exceed 10000.

rithms,  
which are  
trouble-  
some in  
these plain  
Triangles.

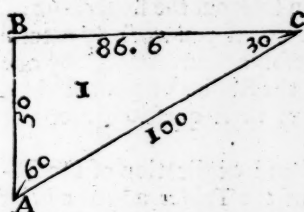
And therefore for the proof and explication of the following way, I have in the end of the Tables added a brief Table of Sines, Tangents and Secants in Natural Numbers, (being somewhat scarce to be had elsewhere) which Table is calculated to every Degree, and tenth Centesim, or sixth Minute of the Quadrant, and by the differences added, you may find any Angle to a minute or hundred part. By which Table if you please, you may sometimes work your Questions, by which you shall better see the nature of the work, and examin the true performance thereof, when you doubt of any thing.

But the way of these my new Tables is much more ready than any of these ways. For I have calculated these Tables to every whole Degree of the Quadrant in such a manner, that they answer to any Radius from one to an hundred expressly and exactly, without any further trouble, but only opening the Book, and turning to your Angle, or side desired. For they are indeed an hundred several Tables all joyned in one Book. And though the greatest expressed Radius doth not exceed an 100: yet this Number of an 100 is as great a Number as you need put for any Radius in most of these Questions. And if at any time your Radius needs to be greater, it is but adding two of these Numbers together, so you have the like for any Number under 1000 or 10000.

These are  
in effect  
100 several  
Tables  
to an 100:  
several  
Radii.

For Example, take this proposition, which is the most ordinary and usefulest in the practice of Navigation, *viz.* By the Rumb and the Distance, to find the difference of Latitude and Longitude.





Thus let Distance sailed be AC 100 miles, and the Rumb or Angle at A, North Easterly 60 Degrees: and therefore the Angle at C is the Complement thereof, or 30 Degrees, and it is desired to find the side AB, which is the difference of Latitude, and the side BC, which is the difference of Longitude.

The way of working by the ordinary Tables of Sines, Tangents and Secants, which is a breviated, and set at the end of these Tables.

To perform this, the ordinary Rules are thus,

As the Sine of the angle at B, Sine 90 d. 10000,

To the side opposed thereto, side AC 100.

So the Sine of the angle at C, Sine 30 d. 5000,

To the side opposed thereto, side AB 50.

So the Difference of Latitude is 50 Miles or Minutes.

Then for the Difference of Longitude,

As the Sine of the angle at B, Sine 90 d. 10000,

To the side opposite thereto, AC 100.

So the Sine of the angle at A, Sine 60 d. 8660,

To the side opposite thereto, BC 86.6.

So the Difference of Longitude is 87 miles or minutes *feré*.

You see here the trouble that there is to find these sides, which cannot be avoided, though the numbers were less, or though (as I said before) you should work by Logarithms; Only in such a case as this, the side AC which is the Radius, being just 100, and so bearing a plain and visible proportion to the Radius 10000, being all one with it, if you cut off the two last Cyphers; So likewise the other two sides have the same proportion to their opposite Sines, being all one with the Sines thereof in the Table, only cutting off the two last figures; and thus they shew the sides to be 50, and 86.6, or 87 *feré*, which would much shorten the work, if it would often, or always fall out so; but this seldom happens, and cannot be expected in the use of the ordinary Tables, which are limited and calculated to one only Radius, of 1000, 10000, 100000, or the like.

But



But now these my new Tables, are calculated to any Radius whatsoever, being express'd and exact from 1 to 100, (and may be made to serve very well to 1000, or 10000, with a very little more labour, as you shall see presently) so that let your Radius be what number soever you have occasion to use, you need only find out your Angles, or any one of the Angles at the top of the Leaves, and your number of Distance in the side or Margent of the Table, and in that Line under the said Angles, you shall find there both your sides together, ready cast up to your hand, without any further trouble. For in those right-angled Triangles, the two acute Angles being alway the Complement of each other, the sides go always both together, as their Angles do, which are therefore fitly termed Cosines.

The way of working by these new Tables.

Thus in this Example, if you turn over the Tables till you come to the angles 60 d. or 30 d. which are both together, and look down the side or margent for your distance run, which was 100 miles; which you shall find at the bottom of the right hand page; you shall find in that line under the title of Sines, those foresaid numbers, 86.60 parts for the one side, and 50.00 parts for the other side, according to the former Calculation.

And thus you shall always find your numbers ready cast up to your hand, let your Radius or given side be what it will under 100. For Instance,

Mark these rules well for they are of great use

	<i>N. pts.</i>	<i>N. pts.</i>
The Radius or 20	The one 17. 32	The other 10. 00
the side A C 30	side is 25. 98	side is 35. 00
being 40	34. 64	20. 00

If your Radius be more than 100, yet if it have a Cypher in the last place, it is but altering the places of the figure in the Table, setting the latter figures a place forwarder, and putting a Cypher at the end thereof. Thus,

	<i>N. pts.</i>	<i>N. pts.</i>
The Radius 200	The one 173. 20	The other 100. 00
being 300	side is 259. 80	side is 150. 00
400	246. 40	200. 00
		Or

Or else at the most, it is but taking your numbers out at twice, and adding them together. Thus if your Radius were 155.

	<i>N. pts.</i>	<i>N. pts.</i>
First, for 100, The one side is 86. 60		The other side is 50. 00
then for 55	47. 63	27. 50
Which added together, make 134. 13		77. 50

Why the numbers in the Table are all parted in two parts.

This parting of the numbers in the Table in the midst is of great use, for the marginal Radius being but to 100, the first part of the number in each Column, answers exactly to the said Radius expressed in the Margent in whole numbers, or Integers, and the two figures following, is only a Decimal Fraction, or rather Centesim thereof, for the more exactness; because the first number very seldom falls out exactly in whole numbers, to any of the said Radii. And therefore I have titled all the Columns thus, *N. pts.* the *N* shews the whole numbers or Integers of your Summe or Measure, and the two last figures the parts or Fraction thereof.

Now, though it be the best way, to reckon the way of your Ship in Degrees and Centesimes, or 100 parts: yet these Tables will serve for any other way of account, either by Sea or Land, though you reckon by Leagues, Miles, or Minutes, Chains, Poles, Fathoms, Feet, or Inches, or any other Measure whatsoever. Always observing this Rule, that look what sort of Measure soever the number which you look in the Margent is of, according to that measure, in the first part of the number in the Columne, shews the whole Leagues, Miles, &c. and the two last figures shews the Fraction thereof in 100 parts.

Thus if your marginal number or Radius be	Degrees	Then the	Degrees and their 100 parts
	Leagues	2 parts of	Leagues and their 100 parts
	Miles or	the Tabu	Miles or
	Minutes	lar Num-	Minutes } and their 100 parts
	Centesims	bers un-	Centesims } and their 100 parts
	of a Deg.	der the	of a Deg. }
	Poles	titles of	Poles and their 100 parts
	Fathams	N. and	Fathams and their 100 parts
	Feet	pts. stands	Feet and their 100 parts
	Inches	for	Inches and their 100 parts

Any

Any of these Integers and parts you may use readily without any Reduction; yea though they are Fractions of Fractions, *viz.* 100 parts of 100 parts, yet they may be added and subtracted, as if they were all whole numbers, only by placing them a place or two forwarder, which is a great ease in the way of Calculation.

Thus, for Example, if you reckon your Ships way in degrees and Centesims of a Degree; the first part of these numbers will stand for Degrees, the latter part for Centesims; but then for exactness, you will have many times the 100 parts of these Centesims fall in, which yet will be without any trouble, either taken in, or left out: whereas other Fractions require Reduction. On the other side, if you reckon your Ships way in Centesims, and their 100 parts, in the addition of your numbers, these Centesims will make Degrees, whose number you may plainly see without any Reduction.

Thus the angle being 30 d.  
the Sine of 545 Centesims, or  
05 d. 45 Centesims.

The angle being 60 d.  
the sine of 5045 Centesims  
or 50 d. 45 Centesims.

	<i>D. C. pts.</i>
05 deg. is	4 33.
45 Centesims	38.79
	<hr/>
	4. 71. 79

	<i>D. C. pts.</i>
50 deg.	25. 00.
45 Centesims	22. 50
	<hr/>
	25. 22. 50

By this you may see the Tables will serve to any number, almost you please, but with exactness, to any number under ten thousand; for if you part your given Number or Radius in two parts, taking still two and two figures together, the Tables will give you the Sine, Tangent, or Secant of that Radius.

How to  
make the  
Tables  
serve to  
any Radi-  
us under  
10000.

Thus

Thus the Radius being 9999, and the Angle 30 deg.

The Sine of 30 d.	The Tangent of 30 d.	The Secant of 30 d.
For 99.00 85 74	99.00 57 16	99.00 114. 31.
For 00.90 85 74	00.99 57 16	00.99 1. 14. 31
86 59 74	57 73 16	115. 45. 31

Which Numbers you may close in the Addition: and cast away the two last Figures, as a Fraction of small value, especially if it be less then 50; and if it be more then 50, you may add one to your Number for it, thus these Numbers will be 8660 *ferè* 5773 (16 11545 (31.

Note this well, for you must have care in placing the Numbers.

But here will be all the difficulty, that these Numbers sometimes having two Figures in both parts, and sometimes three in the first, you must be careful how to part and place them, as you may see by the last fore-named Secant. The best rule I can give you is this, that always when your Number hath 4 Figures, and so you take them 2 and 2, the number of the two latter Figures must be set so, that the two last Figures thereof must stand quite beyond all the other Figures of the first number, and the rest of the Figures must be placed in their order under the first number, and thus doing it: it is no matter whether you keep them apart, as they are set down in the Tables, or set them close together, as here, and as I said before, you may cut off those two last Figures from your total sum, as a Fraction, or add one Integer to the fore-part of the number when it is above 50, and so it shall be agreeable to your Radius.

Thus the Radius being 9999, and the Angle 60 d.

The Sine	The Tangent	The Secant
99.00 4950	99.00 17146	99.00 19800
00.99 4950	00.99 17146	00.99 19800
4999.50	17317.46	19998.00

To make the Tables serve to a Radius of five Figures, and two Figures forward for six.

100000.

Thus

Thus the Radius being 99995, the Angle 60 d.

The Sine	The Tangent	The Secant
For 99.00.0 4950	17146	19800
For 00.99.0 4950	17146	19800
For 00.00.5 0450	0866	1800
49999.50	173183.26	199998.00

Or in these large Numbers, though your Radius have 5 or 6 Figures, yet you may take your number out at twice for the four first Figures, and either neglect the last Figure or Figures, or if they be above 5 or 50, add a Unite to the two former Figures for them.

A short  
good Rule  
to save  
much  
trouble.

And thus you see, that though the marginal Radius of the Tables run but to 100, yet they may very well serve to any Radius under 10000, or 100000, which will be as great (or greater) than you need to use at any time.

But yet there is one point these Tables may seem defective in, and that is, because they are cast up only to whole Degrees of the Quadrant: So that if you have occasion to find these things, for the Halfs, or Quarters, or Minutes, or Centesims, or any other parts of Degrees, you are then somewhat to seek. And this may seem the more considerable, because the Angles of the Rumbs seldom happen to be just whole Degrees.

Though this may seem somewhat considerable in conceit, yet in effect and practice it will come to nothing. For a Degree is so small a part upon the Sea-mans Compass, that it is impossible to steer a Ship so directly, that it shall keep to the true point you reckon upon so exactly, but that you may miss a Degree or two (if not more) if you be not the more careful therein. And therefore it will be exact enough for your account, if you reckon upon just and even Degrees, taking that Degree which is nearest, either under or over, and if there be any odd Minutes, or parts of a Degree in your Angles, you need regard them no farther.

An Apology,  
shewing  
the reason  
why the  
Table are  
cast upon  
ly to even  
Degrees,  
and not to  
Rumbs  
and Quar-  
ters.

But whereas the Rumbs, and their Halfs and Quarters seldom happen to be just even Degrees; and therefore it might be thought more convenient to have calculated these

Yet the  
Rumb  
and Quar-  
ters are

set down  
on the  
sides of the  
Table, to  
those De-  
grees to  
which  
they best  
agree; &  
the true  
quantity  
of their  
Angles &  
Degrees  
& Minutes  
according  
to the usu-  
al way, of  
which you  
may make  
use if you  
please.

Tables to these Rhumbs, and their parts. To this I answer; that though it be good always to steer upon some Rhumb of your Compass or other, because they are most visible thereon, yet by reason of the variation of the Compass, (which you must always allow for in your account) you will have very seldom occasion to keep your account according to the Angles of the Rhumb, but 3, 4, 5, and sometimes 10 or 12 Degrees to the East-ward or West-ward thereof, according as the variation of the Compass in that place requireth. And upon these considerations it would be much more trouble, or far less exact to allow for the said variation in such Rhumb Tables, then in these which are cast up to every Degree: each quarter part of a Rhumb being almost three Degrees.

Your best way of keeping your account in this respect, is first to consider the Rhumb upon which you sail according to the directions of your Compass: then to consider the variation of the Compass, and so to find the true Degree of your Course from the Meridian, reckoning it to be North-East or South-East: North-West or South-West so many Degrees, taking still that Degree which is nearest either under or over, and neglecting the odd Minutes or Parts; and if you be careful herein, that there be no other error then these odd Minutes will make, your account (I dare warrant you) will be exact enough.

But yet I confess, it would be much better in some cases, where the Angles are more exactly known, if these Tables were calculated to some intermediate parts. But this would make them increase to so great a Volum, that few would go to the price; For if they should be calculated but to every 6th Minute, or tenth part of a Degree, this would make them ten times more then they are, which would take up 120 Sheets of Paper in this Figure. But yet because I would make these Tables as exact and useful as I could, I have be- thought my self of a way which shall almost as well perform this, without any such increasing of the Tables; and this is by setting down the differences between each Degree, for every fifth Number or Radius, which differences are so set in the parting of the Columns, that they take up little or no room, and if you carefully proportion them thereby,

How to  
reckon  
the Deg.  
of your  
Course.

you



you may perform this business very exactly: but if you be not careful, you may make your error worse by your curiosity, and therefore for your better direction herein, take these Instructions.

*First*, That these Figures, thus placed, sometimes upward and sometimes downward, express the difference which is between the Degrees wherein they are placed, and the Degree in the Leaf following or preceeding, and not between Line and Line: For that is needless to shew, being better found by the alteration of the Radius, for if you observe the first Line of each Degree, that shews the difference between Line and Line, the Table being made by a continual addition of that first Number.

<sup>1</sup>  
These transversed Figures shew the difference between each deg.

*Secondly*, That this difference here set down, belongs properly to the middle Number of that space wherein it is placed; but yet will serve well enough for any of the other in the said space, if the difference between that and the next space be not too great, and then if you will bestow the pains you may proportion it.

<sup>2</sup>  
These differences belong properly to the middle number of the space.

*Thirdly*, These differences are parted into two parts by a (.) or point, upon the same account which the Numbers in the Columns are parted; so that the first Figures or Part before the Point stands for whole Numbers, in respect of the Radius; and the other Figures after the Point stand for the hundred parts thereof.

<sup>3</sup>  
The differences are parted into Numbers and Parts, as the Columns are.

*Fourthly*, These differences for the most part respect the following Degree, according to the succession of the number of the Degrees in the Table; and therefore they are placed sometimes looking downward, and sometimes looking upward, according as the Degrees are forwarder or backward in the Book. For as the one half of the Degrees, from 1 to 45 go forward, so these differences therein look downward, and respect the following Degree, both according to their number and place in the Book. But then at 45 the Degrees of the Table turn back again, and so run backward to 90 Degrees, and therefore in these the differences are Placed to look upward, or as it were backward, in respect of the Book, but yet are forward, according to the order of the Degrees in the Tables.

<sup>4</sup>  
These differences must properly respect that Degree toward which they look.

*Fifthly*, Look which way those differences look, they are

most



5  
These differences must be added to the degree toward which they look; and subtracted the other way.

6  
The difference in the Sines must be added contrary to the order of the Degrees in the Table.

7  
The difference in the Sines is so proportioned that it may be added or subtracted according to their aspect without any error.

most properly to be added to the parts or minutes of the next degree that way; so that if they look downward, they must be added to the Degree in the following Leaf; if they look upward, they must be added to the Degree in the foregoing Leaf of the Book: but yet you may subtract them (without much Error) from the Degree from which they look.

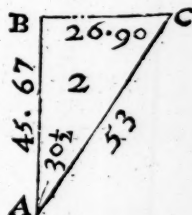
*Sixthly*, In the two Columns of Sines they are placed somewhat otherwise than they are in the Tangents and Secants, (so that they are to be subtracted as the Degrees increase) yet the former Rule concerning them, holds good in these also, that they must be added or subtracted to or from that Degree toward which they look; so that if they look downward, they must be added to the Degree in the following Leaf; and if they look upward, they must be added to the Degree in the foregoing Leaf, though it be contrary to the order of the number of the Degrees.

*Seventhly*, As this difference must be added to the Degrees wherein they are, when they look forward or downward; so they must be subtracted from the Degrees in which they are, when they look upward, or backward. And this Subtraction, though it seldom or never is used in the Tangents or Secants; yet in the Sines both must be constantly used; and you must ordinarily first begin with Subtraction. For these two Columns being the Sine and Cosine of your Radius, if the one be shorter, the other must needs be longer, the Radius being the same. Therefore your first side, or that which lies under your angle, being always the side of Latitude, if that be to be subtracted from; then on the contrary, the other side being the side of Longitude, must have a proportional addition according to the difference thereof, that so the three sides may make up a perfect right angled Triangle.

This is the hardest part of this work, for the proportioning of these Tables, and yet the most useful, and therefore I shall make this, and most of the rest plain by this Example.

Sines.			
	30		60
	N. pts.		N. pts.
51	44	17	25 50
52	45	03	26 00
53	45	49	26 50
54	46	07	27 00
55	47	63	27 50

Sines.			
	31		59
	N. pts.		N. pts.
51	43	71	26 27
52	44	08	26 78
53	45	44	27 30
54	46	29	27 81
55	47	14	28 33



Let your angle at A be 30 deg. and an half, and the number of your Radius or side A C 53, and it is required to find the sides A B and B C.

First, these Tables shew you ( as you may see by this piece thereof ) that if your angle were just 30 degrees, the number of your Radius or side being 53, the longest side should be 45.90 parts, and the shortest side, 26.50 parts.

But in the second place, because your angle is not just 30 deg. but 30 deg. and an half, if you will proportion these sides, according to the difference between this degree and the next, which is 31. deg. you see the difference for this space of the Table at 53, in the one Column is 0.46, which must be substracted, because it looks upward from the following degree. Now the half of this being 0.23 parts, being substracted from 45.90 parts, there remains 45.67 parts for the said side corrected.

45. 90.  
Sub. 23.

On the contrary, the difference of the Cosine in the other Column

45. 67.

26. 50. Columbe being 0.80 parts, which looketh downward, must  
ad 40. be added to the other side, the half therefore of this Difference  
being 40, must be added to the other side, which is  
26. 90. 26.50 parts, which makes it 26.90 parts. And thus you  
have exactly the two sides belonging to this Radius 53, and  
the angles 30 d.  $\frac{1}{2}$ , and 59 d.  $\frac{1}{2}$ , viz. 45.67 parts, and 26.90  
parts, as you may see plainly, if you compare it with  
the following Leaf.

And as here you see the way of work for a half degree, so you may do the like for a third, or a quarter, or a tenth, or any other part of a Degree proportioning the difference in the Table accordingly: and if you will be so curious, by the Table of Proportion (following all the rest of the Tables) you may almost proportion it to a Minute, but very readily to 3 minutes, or  $\frac{225}{1000}$  parts of a degree. And thus those differences being fitly applyed, will make the Tables as exact and useful, as if they were calculated to every tenth part of a Degree, and so increased ten times more in bulk.

Note this well, for it will much help in all the rest.

Last of all, if the proportioning of these Differences seem too troublesome, in most questions of Navigation, you may wholly neglect them; or, at the most, all I would wish you to do, is thus, that when the Differences come to be great, so that they may alter your number, an Integer or two, then you may take notice of these differences, and proportion them according to the former Rule: Wherein also the Tables themselves will direct you when to add, and when to subtract; if you turn but over the Leaf, and see whether the next Degree be more or less, in the correspondent place thereto. And this is the surest Rule of all.

## CHAP. II.

*Shewing the General Use of these Tables, in the Resolution of all Right-lined Triangles.*

**B**Efore I come to the Calculation of these Triangles, give me leave to shew you some general Observations, for your better understanding and proceeding therein.

1. A Triangle is a figure constituted by the conjunction, connexion, or interfection of the three sides or lines thereof, in the three angles or meeting places thereof. So that every Triangle hath six distinct parts, *Viz.* the three sides, and the three angles.

2. The angles of a Triangle are measured by the Arches of a Circle; which is ordinarily divided into four Quadrants; each Quadrant having 90 Degrees, and each Degree 60 Minutes, or 100 Centesims, and according to the quantity of these Arches, they are called either Right angled, or Oblique angled Triangles.

3. A Right angled Triangle, is that which hath one angle thereof (and it can have but one angle neither) equal to the Quadrant of a Circle, or just 90 Degrees: all others are Oblique angled Triangles.

4. Oblique Triangles are either Acute or Obtuse. If they have all their angles less than Quadrants, then they are acute angles; if they have one (and they can have but one) angle greater than a Quadrant, then they are called Obtuse angled Triangles.

5. The three angles of any right Triangle, are equal to two Quadrants, or half a Circle, being 180 Degrees: So that any two of the angles being known, the third angle is the complement thereof to 180 Degrees.

6. This is somewhat more readily found in a Right angled Triangle; for there the right angle being a Quadrant or 90 Degrees, any one of the acute angles being known; the other is the complement thereof to 90 Degrees. Now these and all other modern Tables of Sines, Tangents and Secants, are so framed, that they proceed forward only to 45 Degrees, being half the Quadrant; and then they turn back again till you come to 90 Degrees, by which means you have the acute angle; and the complement thereof to 90 Degrees always joyned together, without any further trouble, which are therefore fitly by Mr. *Gunter* and others, called Cosines and Cotangents.

7. If any angle be greater than 90 Degrees, (and so not to be found in the Tables) take the complement thereof to 180 Degrees, and work by that, and your work will be all one. Or else (as these Tables are framed) you may use the  
Cosine.

Cosine, or Cotangent of the excess above 90 Deg. which is all one with the complement of 180 Degrees.

8. The sides of any plain Triangle may be measured by any Measure or Scale of equal parts, as Inches, Feet, Yards, Poles, Miles, Leagues.

9. Any three parts of a Triangle being known, the other three may be known thereby; unless it be the three angles only of a Right-lined Triangle, and then the proportion of the sides may be found, though not their Length. Now this finding of some parts of a Triangle by the other, is very necessary. For sometimes you may come to measure the sides of a Triangle, and have no Instruments to take the angles: at other times you may observe the angles, and cannot come to measure the sides: Now herein some kind of Calculation is very necessary; and from hence ariseth the several Cases of a Triangle, as sometimes two sides are known, and but one angle; sometimes two angles are given, and but one side, &c.

In most of which cases, this is a General Rule, that the sides and angles have a mutual Proportion each to the other; so that they are known by their opposition one to another; which observed, will resolve most cases in Triangles. For this is true in all Triangles;

As the Sine of any Angle,

To the parts of the side opposed thereunto:

So is the Sine of any other Angle,

To the parts of the side opposed thereunto.

Or,

As the parts of the side of any Triangle,

To the Sine of the angle opposed thereto:

So the parts of any other side of that Triangle,

To the Sine of the Angle opposed thereunto.

10. There is some difference among Authors in the denomination of the three lines of a Right angled Triangle. Some call the sloap side, the Base; and the other two lines the greater and the lesser side. Others call the lower of the two sides, the Base; the other of them, the Perpendicular; and the sloap side, Hypothenufel. It is no great matter

ter which way you call them, so you understand which you mean: But in the Art of Navigation, it will not be unfit to call one of these sides, the Parallel side, or side of Longitude; the other the Perpendicular side, or side of Latitude; and the Hypotenusal, the side of Distance.

These things premised, I shall briefly run over the several Cases of Right-lined Triangles, joyning two Cases together, because these Tables will perform two or three things very well together. And I shall shew you how to do this two ways, first by the ordinary Tables of Sines, Tangents and Secants, which is abbreviated, and joyned to these new Tables: or if you please, you may work them by the Tables of Logarithms; either of which the Rules will agree to; and then I shall shew you how to perform them by my new Tables; whereby you may the better see, not only their ease and readines, but their sufficiency and exactness.

1 Case.

The angles and Hypotenusal given

To find both the other sides;

The side AC is 82, the angles at A and C 30 d. and 60 d.

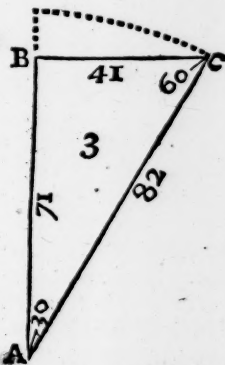
To find this by Calculation, the Rule is thus,

As the Radius, or whole Sine,

To the Hypotenusal;

So the Sine of either of the angles,

To the side opposed to the said angle.



The work  
by Calculations.

Thus as R 10000, to AC 82 :: so sine 30 d. 5000, to BC 41.

And as R 10000, to AC 82 :: so sine 60 d. 8660, to AB 71.

To perform this by these Tables.

Turn to either of the Oblique angles, either 30 d. or 60 d. (for you shall find them both together, the one being the Complement of the other) and look down the margin of that

The work  
by these  
Tables.

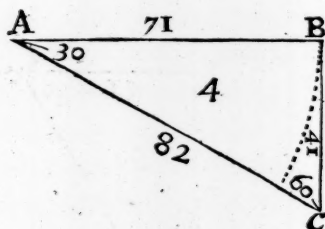


that Leaf, till you find the number of your Hypothenuſal A C 82, and in that line under the ſaid Sines you ſhall find 71.01 parts, for the one ſide, and 41.00 parts for the other ſide.

Caution.

Here, take notice that in theſe Tables, the greater ſide falls under the leſſer angle, and the leſſer ſide under the greater angle, 71.01 parts, being under the angle of 30 d. and 41.00 parts, under the angle of 60 deg. which ſhould not be, for the greater angle doth always require the greater ſide. But this is no fault in the Tables, they being thus tranſpoſed on purpoſe upon good reaſon, as you ſhall ſee hereafter ; and it is to be underſtood always, that the greater angle requires the greater ſide.

The 2 and 3 Caſes.



2 Caſe by the angles, and one of the ſides ; to find the other ſides.

3 Caſe by the angles, and one of the ſides ; to find the Hypothenuſal.

This might be performed by the oppoſition of the ſides to the angles, as before. But it is better to perform it by the Tangents and Secants. Thus the ſide given A B 71, being made the Radius ; the ſide B C will be the Tangent thereof ; and the Hypothenuſal A C will be the Secant thereof.

So that as the Radius 10000,

To the ſide of A B 71,

So the Tangent of 30 d.

By Calculation.

To the ſide B C

5774

40.995

And ſo likewiſe is the Secant of 30 deg. 17321,

To the Hypothenuſal A C

81.9837.

To



To perform this by the Tables, find out your Center By these  
angle at A, which is 30 deg. in your Tables, and look Tables.  
down the Margent of the Leaf, till you come to the number  
of your side A B, which is 71; and in that Line for the  
Tangent of 30 deg. you shall find 40.99 parts, and also in  
the same Line for the Secant of 30 d. you shall have 81.98  
parts, which is the just length of the two sides, being 41,  
and 82 very near, according to the Figure.

The like you shall find, if the side C B were the Radius;  
For finding this side C B 41 in the Margent, the Tangent of  
the angle at 60 d. will be found to be 71.01 parts, and the  
Secant of the said angle of 60 d. is just 82.00 parts, which  
in effect is the same with the other.

The 4 and 5 Cases.

The 4 Case. By the two sides, to find either of the Angles.

The 5 Case. By the two sides to find the Hypothenufal.

In the former Figure,

Making the side A B the Radius,  
As the one side A B 71  
To the other side B C 41  
So the Radius 10000  
To the Tangent of the Angle C 30.5775

By calcula-  
tion.

Multiply 41, by 1000, it makes 41000, which divided  
by 71, makes 5775, which is the Tangent of 30 d. *ferè*.

Thus you have the Angle at A. But for the side A C, you  
must work again by the 3 Case, and find it by the Secant. Or  
else you may find it by adding the squares of the two sides  
together, and subtract the root thereof, and it is the Hy-  
pothenusal.

The Square of 71 is 5041  
The Square of 41 is 1680

Which together makes 6722

Which is the Square of 82, or very near; the true Square  
being 6724.

D 2

But

To perform this  
by these  
Tables.

But this is far more readily performed by these Tables, as thus; you must conceive the side  $AB$ , being the Radius, the side  $BC$  is the Tangent, and the side  $AC$  is the Secant of the center Angle at  $A$ . Therefore turn over the Leaves of the Table, still observing the Radius, which is 71 in the Margent, till you find the other Number, which is 41, under some one of the Tangents, which you shall find under the Tangent of 30 deg. where against 41 in the Margent. you shall have 40.99 parts for the Tangent, therefore the Angle is very near 30 Degrees.

And thus having found the Angle of the Tangent side to be 30 deg. look in the same Line for the Secant of this Angle, and you shall find 81.98, or 82 *ferè*, for the Hypothenufal  $AC$ . Thus neglecting these smaller Fractions, you may conclude the Angle is 30 deg. and the Hypothenufal 82.

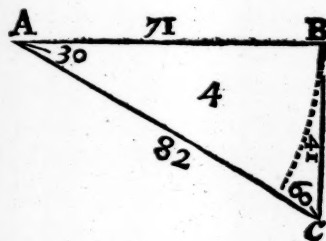
The same you shall find, if you made the side  $BC$  41 the Radius, for against 41 under the Angle 60, you shall find the Tangent to be 71.01 parts, or 71 very nearly, and the Secant thereof is 82.00 very exactly.

### The 6 and 7 Cases.

6 Case. One of the sides, and the Hypothenufal given, to find the Angles.

7 Case. One of the sides, and the Hypothenufal, to find the other side.

This by calculation must be performed at two operations, as before, first, to find the Angle at the Center  $A$ , then to find the side  $CB$  opposed thereto, as thus,



By calculation.

As the side $AB$	71
To the side $AC$	82
So the Radius	10000
To the Secant of the Angle 30 d.	11549

Multiply

Multiply 82 by 10000, it is 820000, which divide by 71, the Quotient is 11549 the Secant of 30 d. *ferè*.

Then the side B C is the Tangent of this angle, as in the 3 Case.

Or else substract the square of the side known, from the square of the Hypothenuſal, and there remains the square of the other side.

The square of the Hypothenuſal 82 is 6724

The square of the ſide A B 71 is 5041

Which ſubtracted, there reſts 1683

Which is the ſquare of 41, the third ſide, or very near the true ſquare, being 1681, this difference is in the angle, not in the rule of ſquares.

To perform this by theſe Tables, the work is only thus, By theſe you muſt make the ſide known A B 71 your Radius, and the ſide A C 82 the Secant thereof: Look over the Tables therefore, till you find 82 in the Table of Secants againſt 71 in the Margent of any Leaf, and this you ſhall find under the angle of 30, where againſt 71 in the Margent, you ſhall find 81.98 parts for the Secant of that Radius. This is therefore the true angle thereof.

Then for the ſide B C, it is only the Tangent of this angle, which you ſhall find in the ſame Line, under the Tangent of 30 to be 40.99 or 41.

The ſame you ſhall find, if you made the ſide B C Radius, for the Secant of 41 is 82.00 parts, under the angle of 60 Degrees. And the Tangent thereof is 71.01 parts, or 71 very near.

## The 8 Case.

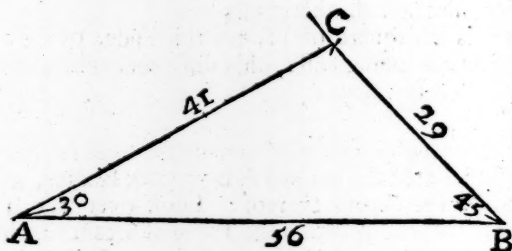
*Of Oblique Triangles.*

The Angles being known and one of the sides, to find the other two sides.

In the Triangle  $ABC$ , the angle at  $A$  is  $30$ , the angle at  $B$  is  $45$  d. the side  $BC$  is  $29$ .

This rule is true in all Triangles, whether Right or Olique.

\* The Sines in these Tables being inverted, shew the Complements of the angles, in respect of their titles, so that you must be careful in which Column you seek your first side, and there is no great danger of erring in the other, because the Triangle will shew which of the two Sines is most likely to be taken.



As the Sine of any angle	A 30 deg. 5000
To the side opposed thereunto, $CB$	29
So is the Sine of any other angle, as $B 45$ deg.	7071
To the side opposed thereto. $AC$	41.

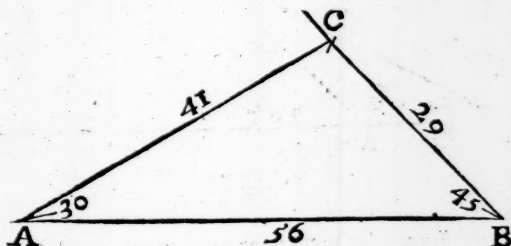
To perform this by these Tables, turn to the angle given, which is  $30$  d. and there you \* should look down that Column of Sines, till you meet with your given side, which is  $29$ : but because these two Columns of Sines are transposed, look down the Column under  $60$  till you meet with your side  $29$ , and mark well in what Line it stands, which is against  $58$  in the Margent. Then turn to the other angle, which is  $45$  d. and in that very Line of the Tables against  $58$  in the Margent you shall have  $41.01$  parts, for the other side  $AC$  which is required.

And so if you would know the side  $AB$  opposed to the angle  $C$ , which is  $105$  deg. you must do the like, only because this angle exceeds  $90$  deg. you must take the complement

ment thereof to 180, or the Cosine of the excess above 90 d. either of which is 75 deg. and under this angle, you shall find against 58 in the Margent 56.03 parts, or 56 for the side A B.

The 9 Case

Two sides with an angle opposed to one of them being given; to find the other angles, and the other side.



This rule is also true in all Triangles, being but the converse of the former; for the sides and the angles have a mutual proportion one to the other. So that

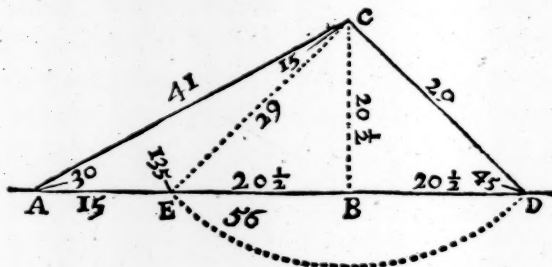
As the side opposed to the angle given	29
Is to the Sine of the said angle 30 deg.	5000
So the side opposed to the angle required	41
To the Sine of the said angle	45 d. 7071

Turn to the Sine of the angle given, which is 30, (but you must take the complement thereof, which is 60, because the Tables are transposed) and there look down that column, until you find your given side 29, which you may observe to stand just against 58 in the Margent. Mark this marginal number, and turn over the Tables, Leaf by Leaf, till you find your other given side, which is 41, just in the like Line against 58 in the Margent, and this you shall find under the Sine of 45 deg. where the number against 58 is 41.01 which being so near, you may conclude it to be the angle sought for.

Thus

Thus these two angles being found, the angle at A 30, and the angle at B 45, being added together, make 75; which subtracted out of 180, there remains 105 d. for the angle at C; and so you may find the side opposed thereto, by the former Rule in the 8 Case.

The 10 and 11 Cases.



10 Case. Two sides with the angle contained, being given, to find the angles. 11 Case. And also to find the third side.

In the Triangle ACD, let the side AC be known to be 41, and the side AD 56, and the angle between them at A 30 d. and it is required to find the other angles at C and at D, and also the side CD,

As the summe of the sides AC 41 and AD 56 97

To the difference of the said sides, 15

So the Tangent of half the angles unknown 75 d. 37321

To the Tang. of the difference of the angl. 30 d. 5771

half 75 Which added to the half of the angles shews the greater  
30 angle; and subtracted from it, shews the lesser angle.

added 105 And thus having all the angles, the side will be found as in  
subt. 45 the 8 Case by the opposite angle.

But it will be as good a way to reduce this Oblique Triangle into two Right-lined Triangles; which may thus be done by letting fall the Perpendicular. CB. To perform which,

1. For the Right angle ABC you have the Hypothenufal AC 41, and the angle at A 30 d. therefore by the first Case the two sides will be CB 20.50 parts, and AB 35.51 parts, or  $35\frac{1}{2}$ .

2. Then subtract this side, 35.50 parts, from the whole Line



Line AD 56, there remains 20.50 parts, and thus you have the two sides of the other Right angle CBD, CB being  $20\frac{1}{2}$ , BD  $20\frac{1}{2}$ , and so by the fourth and fifth Cases, the Tangent of either angle is 45 deg. and the Secant thereof 29, will be the third side. And thus you shall not only have the said side and angles, but all the other parts of the Triangle.

In this operation, sometimes the perpendicular will fall without the Triangle (which must needs be so, when you have an obtuse angle contained between the two given sides) then the work may seem to be otherwise, but it is the same in effect. A second Example of these two Cases.

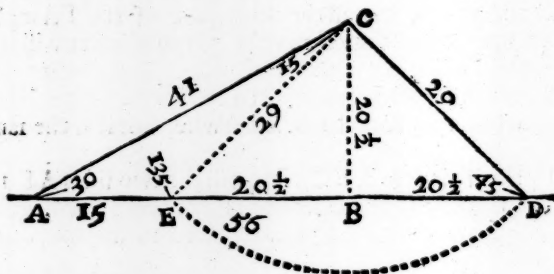
As in the Triangle AEC, suppose the two sides AE 15, and EC 29, and the angle between them being 135 degrees were only known, and it were required to find the other side and the angles.

In this case it will be helpful to you to draw out your Triangle with your Ruler and Compasses, and so you will see that, if you produce the side AE to D, and let fall the perpendicular from the point C, it will fall at B, without the Triangle aforesaid. And thus you have the right angled Triangle ECB, whose Hypothenuſal AC, is known to be 29, and the angle at E must needs be the complement of the obtuse Angle given, to 180 degrees, which being 135 deg. this is 45 deg. and thus having this angle and the Hypothenuſal, you shall find the sides of this right angled Triangle by the first Case. The perpendicular side being  $20\frac{1}{2}$ , and the side EB to be  $20\frac{1}{2}$ . Thus you have one right angled Triangle ECB.

Now for the other right angled Triangle ACB, add the side EB  $20\frac{1}{2}$  to the side AE of the Oblique Triangle, which was 15, it makes the whole Line AB to be  $35\frac{1}{2}$ . And thus you have the two sides of the other right angled Triangle, viz. the perpendicular CB,  $20\frac{1}{2}$ , and the side AB  $35\frac{1}{2}$ , and so by the fourth and fifth Cases, making AB the Radius, you shall find the angle at A to be 30 degrees, and the Secant thereof shews the side AC to be 41. Thus you have all the three sides of the Triangle AEC, and two of the Angles, viz. the angle at A 30 deg. and the angle at E 135, and the angle at C is the complement of these two, to 180 degrees, which must needs be 15 degrees.



## The 12 Case.

*Having the three sides to find the Angles.*

In this Triangle ACD let the three sides be known,

<i>viz.</i>	The side AC	41
	The side CD	29
	The side AD	56

And it is required to find the three Angles thereby.

To perform this, you must first let fall a Perpendicular from the point C upon the side AD, which you may do by setting one Foot of your Compasses in the point C, and opening the other to the point D, draw the Arch DE, and mark where this Arch cuts the Line at E, and divide the space ED into two equal parts, so the perpendicular will fall upon the point B.

But to perform this more exactly by Numbers.

As the greater side AD.	56.
To the Sum of the other two 41 and 29	70.
So the difference of these two sides	12
To the part AE cut off by the Arch DBE	15

This subtracted from the whole Line 56, leaves for the part within the arch 41, the half whereof is  $20\frac{1}{2}$ , which is the place B, where the Perpendicular will fall, reckoned from the angle D, and by this Perpendicular you have divided the

the Triangle into two right Angles, whose sides are known; for DB being  $20\frac{1}{2}$ , subtracted from the whole Line AD 56, leaves for the remaining part BA  $35\frac{1}{2}$ .

Now having these two sides, of these two right angled Triangles, and the two first given sides 29, and 41 being the two Hypothenusals thereof, you may either by the opposition of sides to their angles, as in the 8 Case, or by sides and Hypothenusal, as in the 6 Case find the angles.

These are all, or the most needful Cases, in the resolution of plain Triangles: which might have been set forth with much variety and enlargement: but I rather strive to shew the best and plainest way. And if any thing herein prove difficult, it is such cases as there will be of least use in our intended business of Navigation.

### CHAP. III.

#### *Of Sailing by the Plain Chart.*

**H**AVING premised something in the former Chapters, necessary for the understanding the ground-work of the Tables, and the resolution of plain Triangles in general: I shall now shew the particular application thereof in the most useful questions of Navigation. And herein I shall not multiply many needless Questions, nor strive to branch them out into their several Varieties; but first shall give you those which are most usual and necessary, and then (if occasion permit) shew you some which may be less usual, as briefly as I can.

#### *The first Proposition.*

The first and most usual question in Navigation, is this: By the knowledge of the Rhumb or Course you sail upon, and the distance of Miles, Leagues, &c. that you sail thereon: to know your difference of Latitude and Longitude? That is, how much you are more Northerly or Southerly, in respect of Latitude? and how much you are more Easterly or Westerly, in respect of Longitude?

This is the most ordinary manner of keeping an account

The way  
of keep-  
ing an  
account  
by Tra-  
verse or  
dead rec-  
koning.

of the Ships way, which is usually called the dead reckon-  
ing : And to keep this account, first you see, that the know-  
ledge of the Rhumb they sail upon is always supposed to be  
had, because the Compass by which they steer, either doth,  
or should shew the same exactly. And therefore to this  
purpose the Sea-man ought to be very careful of his Com-  
pass, that it be exactly made, and skilfully ordered, in re-  
spect of the variation, which in most places it is subject to ;  
which must be carefully found out, and allowed for. Se-  
condly, for the keeping this account, you must also know  
how many Miles, Leagues, or hundred parts of a Degree  
your Ship sails upon this Rhumb or point of the Compass :  
which you must find out by the Log-line, or some other way,  
of which you may see somewhat in the 3 Chapter, and  
3 Proposition of the *Geometrical Sea-man*, and I shall shew you  
more hereafter, in the latter end of this Book.

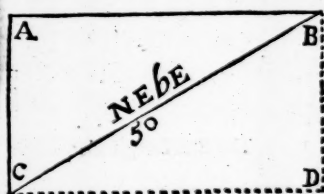
These two things being known, if you work by Calcula-  
tion, the Rule is this ; As the Radius ; to the Distance sailed  
either in Miles, Leagues or Degrees ; So is the Cosine of the  
Rhumb from the Meridian, to the difference of Latitude in  
the like parts.

And again, As the Radius to the distance sailed ; So the  
Sine of the Rhumb to the difference of Longitude.

But the way of working by these Tables is thus far more  
readily.

First, find the angle of the Rhumb at the top of the Ta-  
ble ; and find the number of the Miles, or Leagues, or Cen-  
tesims of the Ship's way in the side of the Table ; and in that  
line under the title of Sines, you shall find how much you  
differ in Latitude in that Column, which is under the angle  
of the Rhumb ; and how much you differ in Longitude in the  
other Column, which is under the Complement or Cosine  
of the angle of the Rhumb.

Thus



Thus in this Triangle ABC, suppose the angle at C to be 56 deg. or the fifth Rhumb from the Meridian, viz. NE by E, let the distance sailed thereupon be CB, which suppose to be 50 Leagues.

The question is, to know how much the point B is Northward from the Parallel CD, which is the length of the line CA, or DB. And likewise how much the said point B is Eastward from the Meridian AC; which is the length of the line AB, or CD.

First, take the Table, and find out the angle of the Rhumb, which is 56 deg. then look down the side of the Table till you find your number of Leagues sailed, which in this Example is 50 Leagues, which you shall find in the last line of the Left hand page, and in that line, in those two Columns, under the title Sines, you shall find 41.45 and 27.96, which shews that the longest of these lines must be 41 Leagues, 45 hundred Parts, or almost an Half, and the other line CA being the Northerly distance, must be 27 Leagues 96 hundred Parts, or almost 28 Leagues.

But now here may be some scruple to those that are not practised herein, to know which of these Numbers belong to either line. This may be more easily known to those who have skill in these things, if they consider whether their Rhumb runs out more in Longitude then in Latitude. As for your young Sea-men this Traverse Quadrate of the Rhumbs, with the directions thereto, will more plainly shew it, then many words; which if well considered, is the substance, and shews the nature and work of all the Tables.

To know which Column shews the difference of Latitude; and which the difference of Longitude.

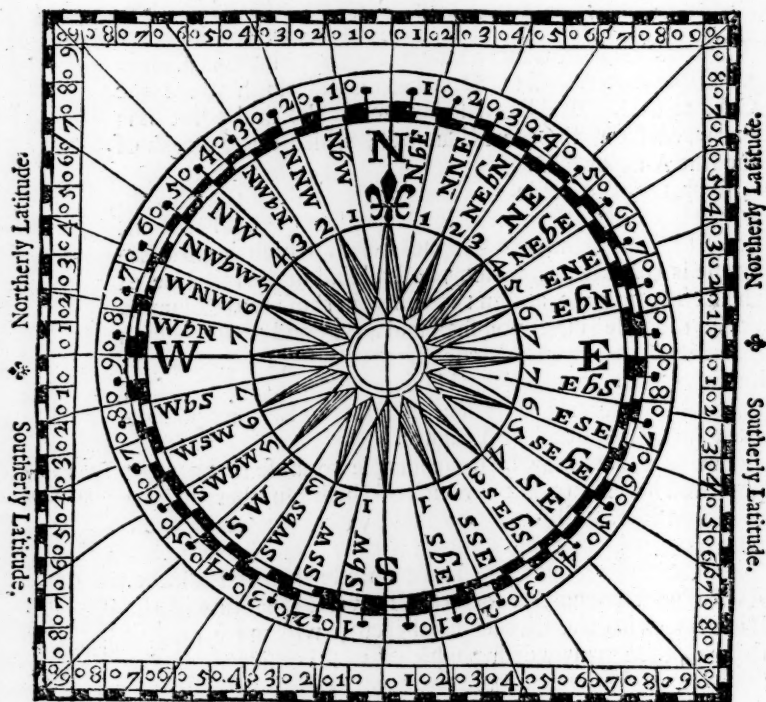
By this you see that the 5 Rhumb from the Meridian, or NE by E, runs more in Longitude then in Latitude, therefore your Northing is 28 Leagues, and your Easting 41 Leagues and an half.

## The Traverse Quadrat.

The West Longitude.



The East Longitude.



The West Longitude.



The East Longitude.

Observe  
this well,  
for it is  
of great

But that this might be the more readily known, I have  
for this very thing (which doth well deserve it) transposed  
the order of this Table of Sines. For whereas the greater  
angle

angle should require the greater side, yet here the greater side is placed still under the lesser angle. And my reason is this; The Rhumb being alwayes reckoned from the Meridian line, the difference of Latitude falls out alwayes according to the Complement of the Rhumb; and the difference of Longitude according to the Sine of the Rhumb; which seems contrary to our usual expressions, wherein we make mention of Latitude, saying the Rhumb lies North-Easterly, or South-Westerly so many Degrees; therefore I have thus placed them, that alwayes under the degree of the angle of the Rhumb, you shall have the difference of Latitude; or the Northing or Southing of your Course, and the number joyned with it in the other Column, is the difference of the Longitude, or the Easting or Westing of the Course. Thus in the Example the number under 56 deg. being 27.96 shews the difference of Latitude; and the number joyned with it, being 41.45, shews the difference of Longitude. This rule well observed will fully guide you in setting down your account, according to your Northing and Southing, Easting and Westing, as you shall see more anon.

Here also I would have you take notice, that what measure soever you account your Ships way in, whether in Miles, Minutes, Leagues or hundred parts of a Degree, the Table will serve your purpose, and give you your Longitude and Latitude, in the same kind of measure, the first Figure in the Column shewing the whole Miles, Leagues or hundred Parts, and the others separated from them, shew the hundred parts of the said measure, which you may for the most part neglect, especially if you reckon your way in Miles, Minutes, or hundred parts of a Degree: or at least, if they be less then 50 parts, or half an Integer, you may neglect them altogether; if they be more then 50, then account one more to your number of Miles, Minutes, or hundred parts.

Thus the foresaid 50 Leagues make 150 Miles, or Minutes, reckoning 60 Miles or Minutes to a Degree, and according to this account the Table will shew you.



Rhumb <i>NE</i> 56 deg.	<i>North</i>	<i>East</i>
for 100 Miles	55.92	82.90
for 50 Miles	27.96	41.45
which makes Miles	83.88	124.35

That is difference Latitude 1 deg. 24 min.

Difference Longitude 2 deg. 04 min. *feré*.

But the best way of account will be by hundred parts of a degree, and therefore though (you see) I do not enforce you, yet I would persuade you to make your Log-line so, that it may shew your Ship's way in Centesims of a degree; for then the work will need no Reduction, but be very ready.

Thus the foresaid 50 leagues, being 2 degrees and an half, or 2 deg. 50 *Cent*.

Rhumb <i>NE</i> 56 deg.	<i>North</i>	<i>East</i>
	<i>D. C. pts.</i>	<i>D. C. pts.</i>
2 Degrees, or 200 C.	1 12 00	1 66 00
50 C.	27 96	41 45
	1 39 96	2 07 45

Or if you think this way somewhat long, you may do it at one entrance into the Tables, with a little consideration: for if instead of 2 degrees 50 C. you take 25, you shall find in the Table 13.98, and 20.71, which by adding a Cypher in the last place, and so putting the Figures a place forwarder, will be 1 D. 39 C. 80 *pts.* and 2 D. 07 C. 10 *pts.*

But as I said before, these lesser 100 parts may be neglected, and so it will be 1 deg. 40 parts, and 2 deg. 07 parts.

And thus having found out the difference of Longitude and Latitude of the place you are come to, by adding it to, or subtracting it from, the Longitude and Latitude of the place you come from, you shall know the Longitude and Latitude of the place you are in at any time, and so readily set it down upon any graduated Chart or Map, and from thence see how you are to steer your next Course.

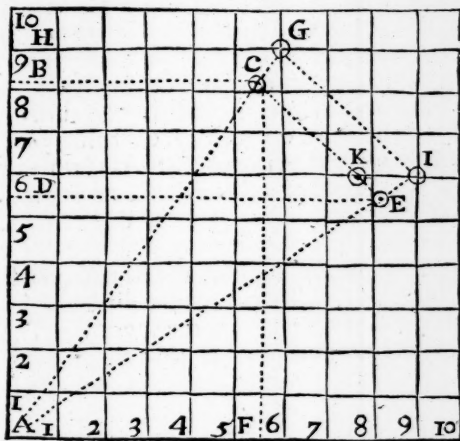
And as you may do thus for one single Course, so you may do for as many as you will, setting them down in the Table; and if you make a blank Map of your Voyage according to your

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either of Latitude or Longitude : and suppose you are bound to the place C, having 8 deg. 30 Centesims of Latitude, and 5 deg. 60 Centesims of Longitude ; The question is to find the Rhumb, between the two places ? and the distance in the Rhumb ?



Here you see the Triangle which you are to resolve, is the Triangle A B C, wherein you have the side A B given, which is the difference of Latitude, 8 deg. 30 parts; and also the side B C is given, which is 5 deg. 60 parts, being the difference of Longitude; and there are two things required, that is the angle of the Rhumb, being the angle at A, and the distance of the two places being the line A C.

Here

Here you must understand that these two sides of the Triangle A B, and B C, are as Tangents, and the line A C is the Secant of the Triangle; and to find the angle of the Rhumb, you must always make the side of Latitude your Radius, and the proportion will be thus,  
As the side A B 8 deg. 30 parts, or 830

To the Radius,

So the side B C 5 deg. 60 parts, or 560

To the Tangent of the angle of the Rhumb 67407,34 deg.

And then,

As the Radius

To the side of Latitude; 830

So the Secant of the angle 12063

To the side of distance. 1001.

But now to work this by the Tables; take your difference of Latitude A B 830, or casting away the Cypher, take the number 83 for your marginal number, and turn over your Tables till you find the other line B C, being 560, or 56, right against it under the title of Tangents (which you may easily do by the succession of Numbers, as you must do in any other Table) and where you find these two Numbers meet thus in one line; the Degrees at the head of the Columns will shew you the angle of the Rhumb, and the Secant in that line also, will shew you the distance.

Thus in this Example if you turn over the Table, you shall not find the Numbers agree, till you come to 34 deg. and in that Leaf, just against 83 in the Margent, you shall have 55.98 parts, which is very near 56, under the said Tangent of 34 deg. this is the true angle therefore of the Rhumb, being very near the third Rhumb from the Meridian, as you may see also in the Margent of the Tables.

And now for the distance of these two places, look in the same line against 83, and the said Secant under 34 deg. is 100.12 which is the distance.

Only thus you must understand it, that in the same sort of parts which you make your side of Latitude to consist of, the same parts must you reckon your distance in. So that if you reckon;

A B to be 83, then A C is 100,

If A B be 830, then A C is 1001,

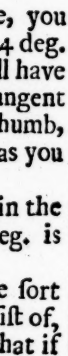
If A B be 8 d. 30 parts, then A C is 10 d. 01 parts.

And

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But yet if you have a mind to find the angle at C of the Triangle A B C, and the length of the Secant line C A that way also, you must make the line C B your Radius, which being 5 deg. 60 parts, or 56, find this in the Margent, and turn till you find the other line B A 83, in the Tangents: this you shall have under the angle 56, where against 56 in the Margent, you shall find 83.04 for the Tangent, and the Secant thereof in the same line also is 100.15, the same as before, without any sensible difference in these accounts.

Thus you see you may find these angles, and the line A C being the distance, either of these ways; but the first is the most proper and useful; For when you make the side of Latitude your first Number, then the other side is the Tangent of the Rhumb you are to sail upon; whereas taking the other side first, the angle found will be the complement of the Rhumb, and so must be subtracted from 90 deg. which though it be not much labour, yet it is needless. And besides, in most of these Cases the Latitude is more certainly known, and so fittest to work by.

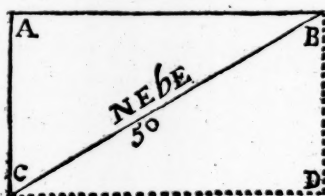
*The third Proposition.*

By the Rhumb and difference of Latitude, to find the departure from the Meridian, or the difference of Longitude, together with the distance sailed; and also several ways how to use the same, to correct your dead reckoning thereby.

It is a common and a very necessary Proposition in most Books of Navigation, to shew how many Miles or Leagues you must sail upon any Rhumb, and how much you must depart from your Meridian, before you alter your Latitude, either by raising or depressing the Pole one degree. And to this purpose there are in several Books, little Tables thereof, which are of as little use, because they only shew the things desired only for one degree of Latitude; so that if your difference of Latitude be either more or less than just one degree, the Tables shews little or nothing, but you must have recourse to the Rule, and so calculate it by the Doctrine of Triangles.

But these Tables are of excellent and ready use for this purpose, for let your alteration of Latitude be any number of parts

parts whatsoever under 100, or one degree; the Tables shew it exactly; for if you turn to the degree of the Rhumb; and and there find the difference of Latitude in the Margent; the Tangent thereof will shew the difference of your Meridian, or Longitude, and the Secant of that angle will shew you the distance sailed in the same parts, without any farther trouble, more exactly then any other Table made for this very purpose, which hitherto hath been published.



Thus in this Triangle ABC the angle of the Rhumb at C being 56 deg. let the difference of Latitude CA be 20, 40, 60, 80, or 100 parts; the departure, and the distance will be as in the Table of Tangents and Secants.

Thus the Angle being 56 deg.

C A the	20 pts.	The Tangent	29 pts. 65	And the	35 pts.	77
difference	40	hereof shews the	59 30	Secant	71	33
of Latitude	60	departure from	83 96	shews	170	30
tude be-	80	the Meridian or	118 61	the di-	143	06
ing	100	Longitude.	148 26	stance.	178	83

The like you may do for any other Angle, or difference of Latitude under a degree; If the difference of Latitude be more then a degree or 100 parts, it is but taking it out at twice, as in the former Conclusions, of which you shall see more in the use of this Proposition, which is of very great use in the correcting of your account of dead reckoning, made according to the first Proposition.

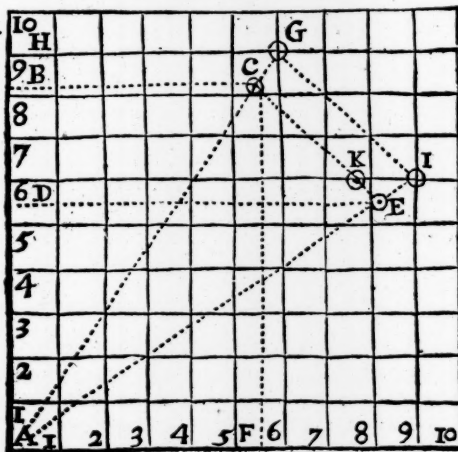
For though the foresaid way of keeping your dead reckoning be of very great and constant use, yet you must not altogether trust unto it: For it is almost impossible to keep this reckoning so exactly, but that you will reckon a little too much or too little; because you cannot give so true an estimate of the Ships way, but that in a day or two, or in sailing 100 or 200 Miles, you may very well mis-reckon 10 or 20 Miles. Sometimes also some unknown Current may set you more forward or backward then you reckon, by as much or more. And, therefore for the proof, and also for the



This is the best way to rectify your account, by observation of the Latitude, with good Instruments, which carefully used may be observed to a small matter.

the correction of your dead reckoning, you must be careful as often as you can, to make exact observation of your Latitude, either by the Sun or Stars; and if the Latitude thus observed, agree with your Latitude by dead reckoning, then you may conclude your account is right: But if the one differs from the other, you must correct your dead reckoning, and make it agree with your Latitude taken by observation.

Now in this rectifying your account, there are these two cases to be considered. The one is when you have failed only upon one Rhumb or point of the Compass. The other is when you have failed upon two or more Rhumbs, & so your way doth not lie in a right line. For the first of these cases.



Suppose you had sailed from A to C upon the third Rhumb, or NE 34 deg. about the distance of 10 deg. and so by your dead reckoning should be in 8 deg. 29 parts of Latitude, and 5 de. 59 parts of Longitude from A; But now suppose that by observation of the Latitude, you find your self to

How to rectify your account, when you have failed only upon one point of the Compass.

be just in 9 deg. of Latitude, and therefore as you are gone further in Latitude, so you must needs be further in Longitude also, being at G, and therefore you desire to know the true Longitude, as well as the true Latitude of this place, and also how far you are failed from the place A.

Turn to the angle of your Rhumb, and find your difference of Latitude in the Margent, and in that line, the Tangent number belonging to that degree, shews the difference of Longitude, and the Secant number in that line also shews the distance you have failed.

Thus

Thus in this Example, if you turn to the angle of your Rhumb, which is 34 deg. and there in the Margent find your difference of Latitude, which is 9 deg. the Tangent against 9 in this line is 6 07, which shews the Longitude is 6 deg. 07 parts, and the Secant in this line under 34, is 10.86, which shews the distance sailed is 10 deg. 86 parts. And thus you have the true Longitude, Latitude, and distance of the place G from the place A.

I know this might be performed by the Tables of Sines only, as Mr. *Norwood* shews. But then the distance must be less, and the Numbers will not be so exact.

In this case it will be best many times to work by the difference of the Latitude, and not by Degrees, so the work will be somewhat more exact.

Your Latitude by dead reckoning was 8 d. 29 parts.

Your Latitude by observation is 9 d. 00 parts.

The difference between them is 0 d. 71 parts.

Find this 71 parts, in the Margent; and under the angle of your Rhumb 34, you shall find the Tangent is 47.90, and the Secant thereof is 85.64, which added to your fore-said account as it ought to be, your true account will be thus.

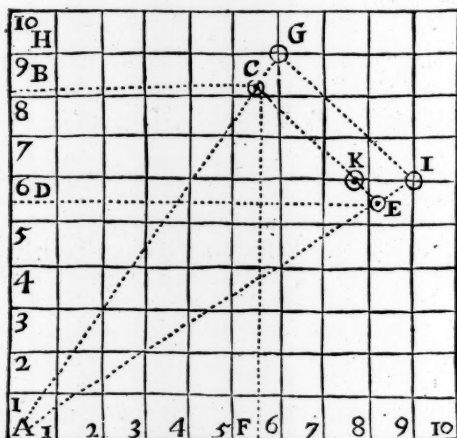
	Distance	Latitude	Longitude
Dead reckoning	10 d. 00 c. 00 pts.	8 d. 29 c. 0 pts.	5 d 59 c. 0 pts.
The difference	85 64	71 0	47 90

The true account is 8; 64 9 00 0 6 06 90

How to rectify your account when you have sailed upon two or three points of the Compass.

The second case is when you have sailed upon two or more several points of the Compass before you can come to have a good observation of the Latitude. In this case you must first find out upon what Rhumb or Angle, the place you are in by your dead reckoning, doth lie from the place you came from, or from the last place where you rectified your account: and this must be the Rhumb or Angle, by which you must correct your account, and not that which you last sailed upon.

As for Example.



Suppose you should sail from A to C, *NE by N*, or *NE* 34 degrees to the distance about 10 degrees, and so should be at C according to your dead reckoning; but according to the true account you should be as far as G, as in the last. And then from this point C, which you think you were in, you should sail *SE*, or upon the angle 45 deg. to the distance of degrees 80 parts; so you would count your self to be at E, whose Latitude is 5 deg. 60, and whose Longitude is 8 deg. 30. But here now observing the Latitude, you find that you are in 6 degrees 07 *C. pts.* of Latitude, so that there is 47 *C. pts.* of Latitude difference between the dead reckoning, and the observation. And as there is this difference in Latitude, so there must needs be a good difference in Longitude: Now the question is how, or which way the Longitude should be corrected?

Here you see your dead reckoning gives your account from A to C, and then from C to E; and now if you should correct your account upon this last Rhumb from C to E, then you should account your self to be in the place K, which hath 6 degrees 07 parts of Latitude, and 7 deg. 83 parts of Longitude. But this cannot be a true correction. For as you

This Proposition is very considerable, and yet is mentioned in any

you were at G, when you thought you had been at C; so other sailing from the point G, South-East, till you come to 6 deg. 07 parts of Latitude, you must needs be in the place I, and therefore neither in E, nor in K. But now all the difficulty is how to find this place I, which is the true place you are in, if you did not know the foresaid correction at G.

To this purpose as I said before, you must find the angle of the Rhumb, from A to E, which is the place you are in according to your dead reckoning, and finding where this Rhumb crosseth the Parallel of 6 deg. 07 parts, which is your Latitude by observation, you shall find it to be in the place I, and this is the true place where you are.

Now to find the angle of the Rhumb from A to E, by the Second Proposition of this Chapter, observe the Triangle ADE, wherein you have the difference of Latitude of the two places, AD 5 deg. 60, and the difference of Longitude DE 8 deg. 30. Therefore turn over the Tables, till you find 8 deg. 30 parts, (or 83, which comes all to one) in the Column of Tangents, against 5 deg. 60 (or 56) in the Margent, which you shall find exactly under the angle of 56, where against 56 in the Margent you shall have 83.04, for the Tangent of 56; this therefore you may conclude is the angle of the Rhumb from A to E, being NE 56 deg. or the fifth Rhumb from the Meridian.

Having thus found the angle of the Rhumb you are to work upon, consider the difference of Latitude between your dead reckoning, and your observation. The dead reckoning gives 5 deg. 60 C. parts, but the observation is 6 deg. 07 parts of Latitude, so the difference is 47 C. pts. Now if you find this number 47 in the Margent under the foresaid angle of 56, you shall have for the Tangent 69.70, that is 70 C. parts *ferè*; which is the difference of your Longitude. Now this added to your former account, your true account will be thus.

	<i>The Latitude</i>	<i>The Longitude</i>
By dead reckoning	5 d. 66 pts.	8 deg. 30 pts.
The difference	47 pts.	70 pts.
The true place	6 07	9 00

Thus this way though it may seem a little troublesome at  
 the

d.

1.27

the first, yet it may be of very good use, and gives the true correction, which you see differs above a \* degree from the correction you should make upon the Rhumb you sailed last upon; and this must needs always give the exact place, if your difference of way upon both Rhumbs, be both alike, or any thing proportionable to each other: And so they must needs be, if there be no unknown current, which may set you more forward or backward upon one of the Rhumbs then upon the other, of which also I shall give you some observations in their place.

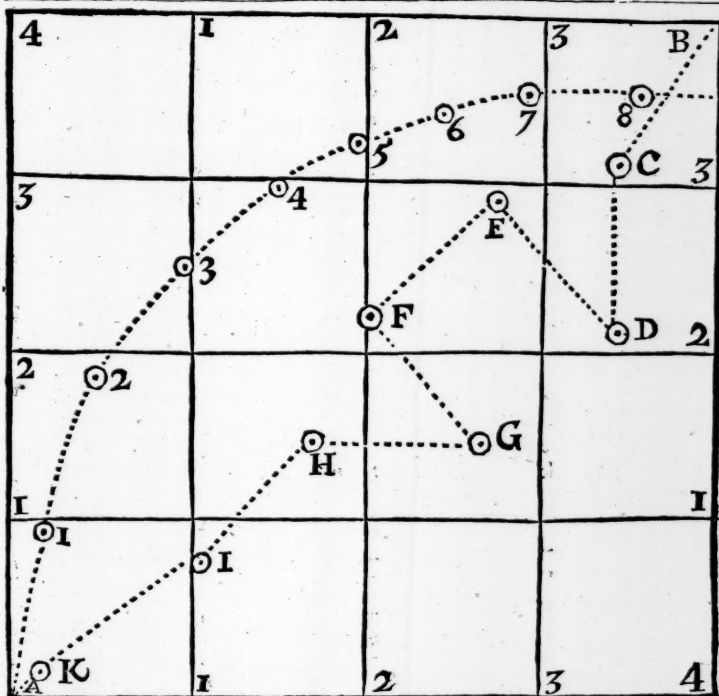
#### CHAP. IV.

*Shewing a Method for the keeping of an account at Sea, according to the former Rules.*

**T**HE three former Propositions, as they are the most useful, so you need almost make use of no other, if you will content your self to keep your account according to the Plain Chart. And therefore in this Chapter I have little more to shew you then in the last, only there I laid down the Propositions severally, here I shall make use of them together.

And first let me advise you, that though you may keep your account, either with your Ruler and Compasses by Geometry, as I shew you in my *Geometrical Sea-man*; or this way by these Tables, by Arithmetick; yet it will be best to use both together. For your Map or Chart will best direct which way any place lies from you, being demonstrated therein better to your eye, then can be expressed by words to the ear; But then these Tables shew the distances of Latitude and Longitude, which you must set down upon the Chart, far better than any ordinary Scale can do, though you should make every League an Inch long. Besides, it is somewhat troublesome to set off those small daily distances according to their true Rhumb upon the Chart, and when they are set down so, yet the chief thing which you are to look after, which is the difference of Longitude and Latitude of the said distance, is more troublesome to find out if you work so exactly as you ought to do; which these Tables shew

It is best  
to use the  
Plain  
Chart and  
these Ta-  
bles both  
together,  
for the  
one helps  
the other.



shew most exactly at the first sight, so that you need not be so curious in setting down this afterward upon the Chart, but may make use of any little draught, and set down the places therein according to their Longitude and Latitude, even by your eye, as near as you can guess them; for this is to serve only for your better and general direction, when to add and when to subtract, your account being still to be kept by the Tables, which will shew your Longitude and Latitude most exactly. Thus these two ways joyned together, will much help each other, and be the best way for the keeping of your account at Sea that you can use.

As for the making of the Plain Chart, it is most easie making the degrees of Latitude & Longitude equal every way, so that the Figure thereof, without any farther direction, is enough. But you may see more in my *Geometrical Sea-man*, Chap. 3.



As for the framing of the Table of your account, it is very plain; so that you may any time make the like, it is only divided into 10 Columns, whose titles exprefs in short what they stand for, *viz.*

The first shews the place of your Harbours or Observation.

The second shews the Rhumb from one place to the next.

The third the angle of the Rhumb, with allowance for the variation when there is need of it.

The fourth the distance or way sailed in Leagues, Miles or Centefims.

The four next Columns shew the *N. S. E.* or Westing of that Rhumb, and distance, as you find it in these Tables.

The ninth Column by the Addition or Substraction of the Northing and Southing, shews the Latitude of any of the said places.

The last by the Addition or Substraction of the Easting and Westing, shews the Longitude of any of the said places.

The places.	Courfe.	Angle Rhumb	Dist. C. pts.	North C. pts.	South/East C. pts. C. pts.	West C. pts.	Latit. D. pts.	Longit. D. pts.
The place A.		d.					0 0	0 0
from A to 1.	<i>N by E</i>	<i>NE 11</i>	100	98	19		0 98	0 19
from 1 to 2.	<i>NNE</i>	<i>NE 22</i>	90	33	34		1 81	0 53
from 2 to 3.	<i>NE by N</i>	<i>NE 34</i>	80	66	45		2 47	0 98
from 3 to 4.	<i>NE</i>	<i>NE 45</i>	70	49	49		2 96	1 47
from 4 to 5.	<i>NE by E</i>	<i>NE 56</i>	60	33	50		3 29	1 97
from 5 to 6.	<i>E NE</i>	<i>NE 68</i>	50	19	46		3 48	2 43
from 6 to 7.	<i>N by E</i>	<i>NE 79</i>	50	09	49		3 57	2 92
from 7 to 8.	<i>East.</i>	90	65	00	65		3 57	3 57

5.65 | 3.57 |

3.57 |

Here you see the first place A, is supposed to be under the Equinoctial, having 00 deg. 00 min. of Latitude or Longitude.

The Example in the Tables and Chart explained.

In the next place from this place A, to the point 1, the Course being the first Rhumb from the Meridian *N by E*, or *NE 11* deg. and the distance thereon 100 *C. pts.* of a degree. If you look this angle of 11 deg. in the Table, you shall find the Northing of these 100 *C. pts.* is 98 *C. pts.* and the Easting

Easting 19 *C. pts.* (omitting the lesser parts in the Table as needles.) And so the Latitude of this place will be *Norib* 0 deg. 98 parts, and the Longitude *East* 0 deg. 19 parts.

Then the second course from 1 to 2 being *NNE* the second Rhumb from the Meridian or *NE* 22 deg.  $\frac{1}{2}$  and the distance therein 90 *C. pts.* turn to this angle of \* 22 deg. or 23 deg. in the Table, you shall find for 90 *C. pts.* the North- ing is 83 *C. pts.* and the Easting is 34. Now the Northing of this place, added to the Latitude of the former, and the Easting of this place added to the Longitude of the former, shews the true Latitude and Longitude of this place.

\* The angle be- ing 22  $\frac{1}{2}$ , you may either take the 22, or 23 deg. the difference will not be much: or if you will, you may proportion it by the difference between them, 25 these Numbers are.

The Latit. of the last place	0 deg. 98	The Longit.	0 d. 19
The Northing of this place	83	The Easting	34
So that the Latit. of this is	1 deg. 81.	and the Long.	0 d. 53

Thus the Table all along will shew you the Longitude and Latitude of the place you are in, by which you may at any time set it down upon your graduated Chart, and so better see whereabouts you are, and how to direct and account your following course.

Only take notice that whereas in this Example, you have always added the Longitude and Latitude of the following places to the former, because the Longitude and Latitude thereof is still supposed to increase; so when your Longitude and Latitude doth decrease, you must use Substraction; and if the one doth increase, and the other doth decrease, you must accordingly use Addition in the one, and Substraction in the other. In all which the very looking upon your Map or Chart, and considering of your course, with a little practice, will be very plain unto you. And yet for your better instruction in this so necessary a business, I have added this Example, wherein you shall see most of these varieties, that can happen in your account. And though some may think this needless, yet I desire herein to be so plain, that every one may understand it. And withal take notice, that this variety of operation sometimes by Addition, sometimes by Substraction, is not caused by reason that you work by these Tables, but whatsoever way you work to find out the difference of Longitude and Latitude, you must according as the Course requires, make sometimes Addition, and sometimes Substraction as you do here.

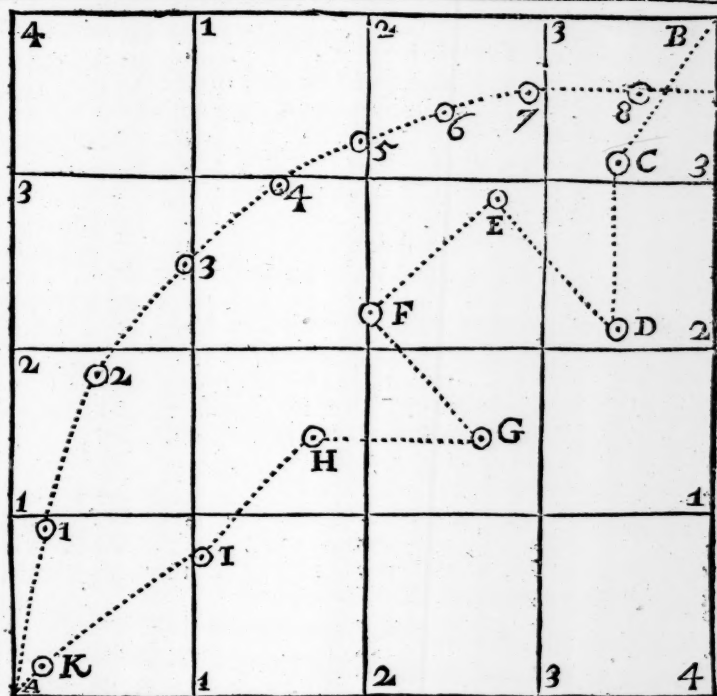
The

The Places.	The Rumb or Course.	Angle of it.	Dista.					Latit. D. pts.	Longit. D. pts.
			C. pts.	C. pts.	C. pts.	C. pts.	C. pts.		
The place B.		d.						1 00	4 00
from B to C.	<i>S W by S</i>	<i>SW 34</i>	100		83		56	3 17	3 44
from C to D.	<i>S</i>	<i>S 00</i>	100		100		00	2 17	3 44
from D to E.	<i>N W</i>	<i>NW 45</i>	100	71			71	2 88	2 73
from E to F.	<i>SW</i>	<i>SW 45</i>	100		71		71	2 17	2 01
from F to G.	<i>S E</i>	<i>SE 45</i>	100		71	71	1 46	2 73	
from G to H.	<i>W</i>	<i>S 00</i>	100		00		100	1 46	1 73
from H to I.	<i>SW</i>	<i>SW 45</i>	100		71		71	0 73	1 02
from I to K.	<i>SW by W</i>	<i>SW 56</i>	100		56		87	0 0	1 19

Mark this well, and it will direct you in any course whatsoever.

Here you see the first place from whence you set sail, being supposed at B, whose Latitude 4 is deg. and whose Longitude is also 4 deg. this is first set down in the Table. Then from B to C suppose you sail *SW by S*, or *SW 34* deg. the distance of one Degree, or an hundred *C. pts.* find this angle 34, and in the Table of Sines, for the distance of 100 *C. pts.* you will find 83 *C. pts.* for the Southing, and 56 *C. pts.* for the Westing, and here because the Longitude and Latitude doth both decrease, this must be subtracted from the Longitude and Latitude of the former place; so your Latitude of C will be 3 deg. 17 parts, and the Longitude 3 deg. 44 parts.

Now if you sail from this place C to D full South 100 *C. pts.* Here you need only subtract this difference of Latitude out of the former, so that the Latitude of the place D is 2 deg. 17 parts, and the Longitude the same as before, 3 deg. 44 parts.



But now if from hence you sail to E, which is *NW* 100 parts, find this angle 45 deg. in the Table, and you shall find for the Northing of the 100 parts, 71 parts, and for the Westing 71 parts. In this Course you may see the Latitude increaseth, therefore that must be added, but the Longitude decreaseth, therefore that must be subtracted: So the Latitude of the place at E is 2 deg. 88 parts, and the Longitude is 2 deg. 73 parts.

From hence to F both the Latitude and Longitude decreaseth, so they must both be subtracted as in the first Course.

From F to G the Latitude decreaseth, therefore is subtracted from the last Latitude, but the Longitude encreaseth, and therefore is added to the Longitude of the former place.

From G to H there is only difference in Longitude, which is to be subtracted. From thence to I and K the Latitude and

3. Latitude increaseth, Longitude decreaseth.

4. Longitude and Latitude both decrease.

5. Latitude decreaseth, Longitude increaseth.

and Longitude both decrease, and therefore are both subtracted. And now being at K your Latitude is 0 deg. 19 parts, and your Longitude is 0 deg. 19 parts; so that you are within 27 *C. pts.* of the place A, which may be supposed for the place whither you intend your Voyage.

Thus these small parcels of your reckoning, which are very troublesome to set down upon your Map or Chart, with your Ruler and Compasses, and cannot be set down so, neither with any exactness or certainty, may thus be most readily and certainly cast up, and so set down in any Map or blank Chart, either severally, or once for many times, as you will, observing their Longitude and Latitude; and so when you please you may make a prick or point in your Chart, and see whereabouts you are at any time, without any farther trouble; yea, if you please, you may do this only by guessing with your eye whereabouts the place should stand according to the Longitude and Latitude thereof.

**Caution.**

This way of plain sailing is to be used only in short distances, or in places near the Equinoctial,

But in this way of your reckoning your Longitude and Latitude, you must be under, or near the Equinoctial, where the Degrees both of Longitude and Latitude are equal each to other. For else though you may reckon the true Latitude of a place, yet you will fail much in the Longitude thereof. Only thus much you may reckon upon in all places; that as you are so much, that is so many Miles or Leagues to the North or South of any place; so you are also so many Miles or Leagues to the East or West of that place. Which how you shall reckon up into degrees of Longitude, I shall shew you also in its place.

for though it shews the true Latitude, yet is very unfit to shew the Longitude, unless it be near the Equinoctial, where the deg. of Longitude and Latitude are both alike of equal length and breadth.

## CHAP. IV.

*Of Currents at Sea, how to find them out, and how to allow for them in your account.*

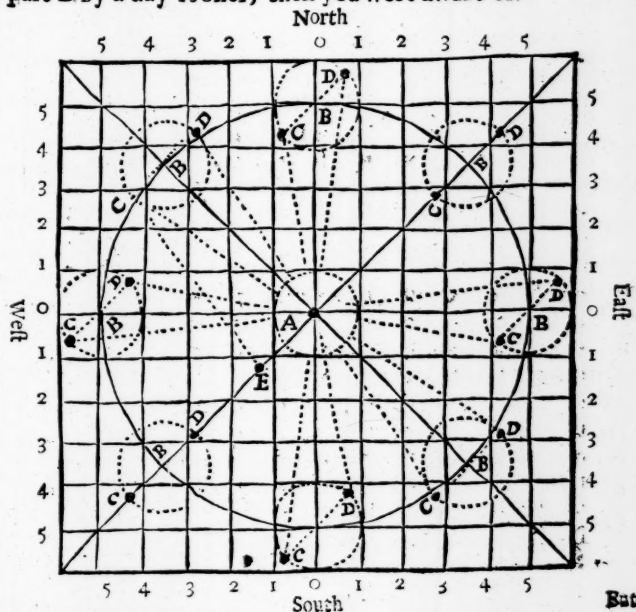
**T**His observation of Currents, though it be of great use, yet as there hath been little written thereof, so (the more is the pity) there is not such regard and observation of it as there ought to be. For as the ignorance hereof doth many times confound men, and make them at a loss in their accounts:

accounts: so a true knowledge thereof would as much direct them, and further them in their Voyages. And without the knowledge hereof in some sort, you can keep no true account of your way, neither by your dead reckoning, nor by observation of Latitude.

To make instance in that notable Current which is observed in the Western Ocean to run toward the North-West.

Suppose A to represent the *Summer Islands*, and the Current thereabouts to run *N E* about 12 Miles, or 20 *C. pts.* of a degree every day: If you were to sail with this Current from A to B (*viz.* that B which lies full North-East from the center A) being from it about 5 degrees, or 500 *C. pts.* every day that you sail thus with the Current, the said Current will set you forwarder then your account by 20 *C. pts.* So that though you think you sail but 1 deg. or 100 parts a day, for 4. dayes time, and so reckon you are come but to C, which is 4 degrees, or 400 *C. pts.* of your way, yet the Current in that 4 dayes time running 20 *C. pts.* each day, will set you forwarder 80 *C. pts.* So that you will be at, or near your part B by a day sooner, then you were aware of.

In this Example look only upon the *N. E.* line of the Figure.





In this Example look only upon the S. 17. line of the Figure.

But now, suppose you were to sail from B to A back again, or, which is all one in effect, from A to that B which lies South-West, opposite to the former. Here now every day that you sail upon this course, the Current will set you back 20 *C. pts.* So that though you sail according to your dead reckoning 100 *C. pts.* every day, for 5 dayes together, and so should think your self to be at B, yet the Current in that time will set you backward 5 times 20 *C. parts*, so that you will have sailed but 400 *C. pts.* and so are but at D, and want a full days failing to your place B.

But when you thus sail either directly with, or against the Current, there is not so much danger as at other times, because though the Current sets you forward or backward; yet it doh not alter your Course, and so you may easily correct your account by observation of the Latitude. But if you sail upon any other point of the Compass, the Current will not only alter your speed, but drive you out of way, so that without some knowledge hereof, and care to prevent it, you may in failing to some lone Island, be at such a loss, that you know not which way to steer your course, whether East or West.

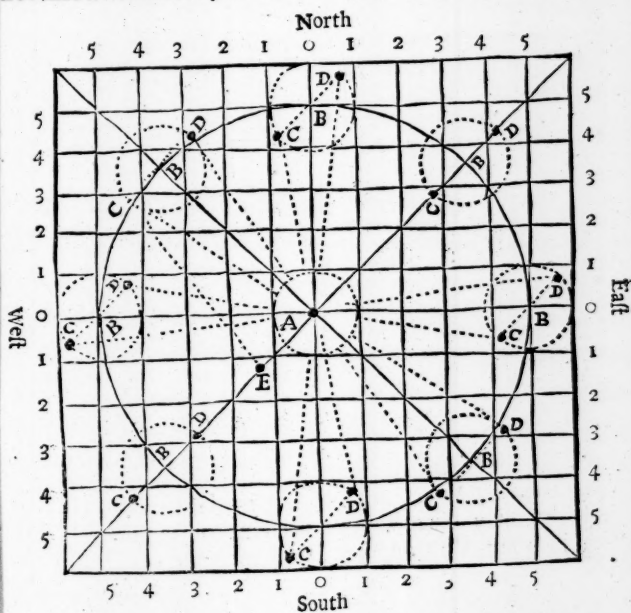
In this Example look upon the North line of the Figure.

For Example, suppose the Current to run *NE* as before, 20 *C. pts.* every day, and that you were to sail therein full North from A to B. Here when you think you sail directly North from A to B, the Current running North-East, will cause you to make your way from A to D, so that when you shall think your self to be at B, you will find (or rather loose) your self at D. For if you are not aware before of the Current which way it hath driven you, you can by no means know which way to direct your course. For though by observation of the Latitude at D, you may think your self beyond it; yet if you sail directly back again toward A, till you come to the Latitude of B, yet you will not find the place there; neither can you tell which way it lies, whether Eastward or Westward. And this, if the place you sail to be a little lone Island, you will be at a great loss, and not know which way to turn your self, as some have been in this case: And this I suppose hath been the ground and reason of those strange stories of floating and invisible Islands in the great Western Ocean.

The like or rather the contrary will happen, if you were

to sail South from B to A, or which is all one in effect, from A to B, which lies full South. Herein when you think your self at B, the current will drive you to D, and though you find your self short in Latitude, and so think to find the place B by sailing still South, yet you will fall besides the place, and not know which way to sail to it, unless you know whether

In this Example look upon the South line of the Figure.



the Current hath driven you to the Eastward or Westward of the place you are bound to.

To prevent this loss, it is usual by those who are careful, not to sail point blank upon such little Islands, but to be sure get into the Latitude of the place, a good way either to the Eastward or Westward thereof, as their way best lies for it, and so being sure which way the place lies from them, to keep in that Latitude, till they are in sight of the place desired.

This I confess is a good careful way to prevent such mishaps, but many times there may be loss of time, and way therein; both which might be prevented, if the true Current

rent were known; for so you might know how to direct your Course more readily to any such place, and how to allow for the Current upon any Rhumb whatsoever, so that by observation of your Latitude, you might find your true Longitude most exactly, which else will never be done.

For upon what point of the Compass so ever you sail, the Current will bear you off the way, as you may see by the other little circles marked with the Letters C B D, in all which the lines A B shew the Rhumb and way which you think you sail. The lines A D shew the Rhumb and way which the Current bears you. And the lines A C shew the true way whereby you should, and might sail best to the said places marked with B.

This plain demonstration of the necessary use of these observations, will, I hope make you more careful in the searching out of these things. And as I shall give you the best directions I can to find these secrets, so I would have you to make known what discoveries you shall make thereby. For if Sea-men would but make known these discoveries, to those who are skilful in these Arts, the Art of Navigation would in a short time be much advantaged thereby.

The best way to find out these Currents, is by keeping exact account of your way both outward and homeward, according to your dead reckoning, being very curious in observing the way your Ship makes by your Log-line. For though you may correct your account for your better direction in your Voyage, yet it is not your corrected account, but your dead reckoning that must help you herein. And therefore you must be very careful of that, trying how the Ship goes by it many times, when you have little or no need, as when you sail near the Meridian. For hereby you shall be more perfect in this way of account, and finding how your Ship's way agrees with your line, you may the better know how to use it, and trust to it, when you have more need thereof.

In sailing  
in this cur-  
rent from  
A to B  
North-

The manner of this work will be made more plain by two or three Examples than many directions.

Suppose you were to sail from A to that B which lies North-West from A, being about 5 degrees distant; and (either knowing or suspecting the nature of the Current) you

you should not fail the direct way North-West, but a point more to the Westward, viz. *NW by W*, to the distance of 5 deg. 15 *pts.* or 515 *C. pts.* in the space of five dayes, and so whereas by your dead reckoning you should be but at C, yet you should arrive at your Port B. And then when you return home again, you should neither fail the direct way from B to A, which is South-East; nor by the opposite point you came upon, which is C A, and lies *SE by E*, but should continue your account as it were from C, and steer your course back again from C upon the third Rhumb *SE by S*, as if you were to sail from C to E; and now having sailed hereupon likewise 5 deg. 15 *C. pts.* in five dayes, you should find your self to be returned to A. And now by this different reckoning you would know these three things.

1. Which way the Current sets? 2. How fast it runs?
3. The true difference of Latitude and Longitude of these two places?

West, your account outward will be as if you were to fail from A to C, & your account homeward will be as if you were to fail from C to E; & yet by reason of the Current you will come to the place

First to this end make a Table of your account outward A. and homeward, according to the former rules.

From A to C	deg. <i>C. pts.</i>	N	S	E	W
<i>NW by W</i> or	5 0	2.80			4.5
<i>NW</i> 56 deg.	0 15	08			12
5 deg. 15 <i>C. pts.</i>		2.88			4.27

From C to E	Deg. <i>C. pts.</i>	N	S	E	W
<i>SE by S</i> or	5 0		4.15	2.80	
<i>SE</i> 34 deg.	0 15		12	8	
			4.27	2.88	

Now these two accounts being both contrary in each part, must be subtracted from each other, viz. the North from the South, so there will remain South 1 deg. 39 *C. pts.* And the East from the West, so there will remain West one degree, 39 *pts.* also. By which it appears that you have been forced to go 1.39 *C. pts.* Southward, and also 1.39 *C. pts.* Westward more then you need have done, for else the way outward and homeward would have ballanced the one with the other: whereas now you see there is 200 *C. pts.* difference

S 4 27  
N 2 83  
Rest 1 39  
W 3 27  
E 2 88  
Rest 1 39

difference, for whereas you are come back again to the place A, yet your accounts make as if you were at the place E, which is South West from A 200 *C. pts.*

Now in the first place, to know which way the Current runs, you see that whereas by your accounts you should be at E, which is South-West from A about 200 *C. pts.* yet you find your self to be at A, so that the Current in this time hath driven you from E to A, which is North-West 200 *C. pts.* As farther appears, if you compare the Southing of your account extraordinary, which you found before to be 1 deg. 39 *C. pts.* with the Westing thereof, which was likewise 1 deg. 39 *C. pts.* so that the Southing and Westing being equal, it must needs make an angle of 45 deg. and so run North-East, as I said before. Now the Secant of this angle for 1 deg. 39 *C. pts.* will give 196.57 *C. pts.* which is almost 200, as I said before.

By the 4  
& 5 Case  
of plain  
Triangles.

Then in the second place if you consider the time, outward, which was 5 days, and home again 5 days, in all 10 days, and divide the foresaid 200 by this, you shall find that every day the Current runs 20 *C. pts.* which is 12 Miles every day.

Thirdly, though there is much difference in the Longitude and Latitude of these two accounts outward and homeward, so that you cannot tell what is the difference of Latitude and Longitude between these two places, by any one of them: yet if you add these two accounts together, and then take half of them, you shall have the true difference of Longitude and Latitude of these two places A and B.

Thus your account outward *Nor.* 2 d. 88 *pts.* West 4 d. 27 *pts.*  
and your account homeward *Sou.* 4 27 *East* 2 88

The Sum of these two are  $\begin{array}{r} 7 \\ 15 \end{array}$   $\begin{array}{r} 7 \\ 15 \end{array}$

The half shews the true dif. of lat. 3  $57\frac{1}{2}$  and lon. 3  $57\frac{1}{2}$

And hereby also it appears that the true Rhumb between the two places is North-West.

To make this more plain, take another example. Suppose you were to sail from A to that B which lies full North, having five Degrees difference of Latitude, but under the same



same Meridian; and that you should sail thither upon several points of the Compass, in six dayes time as in the following Table.

	Course.	Dista.	North	South	East	West
The first day.	NW	100	71			71
The 2 day.	NW by N	100	83			56
The 3 day.	NNW	100	92			38
The 4 day.	N by W	100	98			19
The 5 day.	NE	100	71		71	1. 84
The 6 day.	East.	30	00		30	
			4. 15		1. 01	Reft 0. 83
Current.	NE	120	85		85	
			5. 00		R. 02	

By this you may reckon the place B, to be 4 deg. 15 C. pts. to the Northward and 0 deg. 83 pts. to the West, the Easting being subtracted.

Now suppose you should sail back again to the place A in 6 dayes and an half, as in the following Table.

	Course.	Dista.	North	South	East	West
The first day.	SW	100		71		71
The 2 day.	SW by S	100		83		56
The 3 day.	South	100		1. 00		00
The 4 day.	South	100		1. 00		00
The 5 day.	South	100		1. 00		00
The 6 day.	South	100		1. 00		00
The ½ day.	SE	50		35		1. 27
				5. 89	35	S. 35
						R. 92
Current for 6 dayes ½.	NE	130	5. 92		92	Reft
			Reft 4. 97	Subst.	00. 0	

By this it should seem that the place A is to the Southward from B, 5 deg. 89 C. pts. and Westward 0 deg. 92, which doth much differ from the account outwards. Now



to reconcile them; and to find the Current, which way it sets, and how fast it runs.

First compare the two accounts together, and subtract the North from the South; but add both the Westings together, because they are of one sort: so you will find the Current hath caused you to go out of your way to the Southward 1 deg. 74 *pts.* and to the West 1 deg 75 *pts.* which Southing and Westing being equal, the Current must needs run Northwest.

North 4 15  
South 5 89  
Rest 1 74  
West 0 83  
West 0 92  
Sum 1 75

Secondly by the fourth and fifth case of plain Triangles having the two sides of the Triangle, the Secant thereof, or the distance which the Current hath run in this time will be 247 parts, which divided by the time 6 dayes outward, and 6 dayes and an half homeward, in all 12 dayes and an half, gives about 20 parts for each day, and 7 parts for the half day: so that you may conclude the Current runs 20 *C. pts.* which is 12 Miles a day.

Lastly, for the true difference of Longitude and Latitude of these two places; add the sums of the North and South Columbus together, they make 10 degrees, or little more, the half whereof is 5 deg. which is the difference of Latitude. For the difference of Longitude, because both wayes it falls out to be Westerly; you must not add them, but subtract the one from the other, and the half of the remainder will be 4 *C. pts.* which shews these two places differ little or nothing in Longitude.

N 4 15  
S 5 89  
10 04  
25 02  
W 0 83  
W 0 92  
0 09  
0 04

By this which hath been said, I hope you will be instructed not only how to find these Currents, but how to use them. The best way for you, will be to keep two several accounts, the one of which you may correct according to your observation, the other keep only by the Log-line. And if you find any time that your observations do differ more than the ordinary, from your dead reckoning, you may well think there is some current which drives you out of the way.

\* The way how to do this is expressed at the bottom of the former accounts.

To conclude this point, when you know how fast any Current runs, and which way it will be good to set down in your account, some \* allowance for it every day, or at least every three or four dayes, so your accounts will better agree, and be most exact both for Longitude and Latitude. Thus in your account outward, allowing for the Current NE

20 parts

20 parts a day, for the six dayes 120 parts. This by the Tables yields 85 parts for the Northing, and 85 parts for the Easting, which Northing added to the former, make the difference of Latitude 5 deg. and the Easting subtracted from the Westing, there remains for the difference of Longitude, only 2 parts, which is little or nothing in these accounts.

Likewise in the account homewards for the current *NE* 130 parts for the 6 dayes and an half, this yields for the Northing 92 parts, and for the Easting 92 parts; which 92 parts Northing, subtracted from the Southing 5 deg. 89 parts rest for the difference of Latitude, 4 deg. 97 parts. Likewise the Easting subtracted from the Northing, rest for the difference of Longitude just 0. And thus you have the true difference of Longitude and Latitude of these Courses and Distances, as at first propounded, without any sensible difference in these accounts.

## CHAP. VI.

*How to make a true Chart for any part of the World.*

ALL that I have hitherto spoken concerning Sailing, is chiefly (if not only) meant of your sailing by the plain Chart; concerning which I might add many other Propositions, which I shall refer to another place. But you must know that most of these Propositions, will not be truly performed, (especially in respect of Longitude) unless you are in places near the Equinoctial, where the degrees of Longitude and Latitude are both equal. And therefore our Country-man Mr. *Ed. Wright* invented (although *Mer-icator* a forreigner almost got the name and praise thereof) a very excellent Sea-Chart, which performed the like conclusions, and almost in the like manner, and with as much readines as the plain Chart doth; but with far more truth, in all places, which have any Latitude. The making and use of this Table, is now generally as well known as the Plain Chart, and therefore I shall not spend much time to

instruct

instruct you in the making thereof, but rather shew you how these Tables may help you in the use thereof.

Yet because these Tables may somewhat help you in the making of these Charts, when you want a Table or a Scale of the Meridian line, you may soon make one by these Tables of Secants, beginning at any Latitude you will.

<i>D.</i>	<i>Seca.</i>	<i>Merid.</i>
50	000	000
51	159	156
52	162	321
53	166	487
54	170	657
55	174	831
56	179	1010
57	184	1194
58	189	1383
59	194	1577
60	200	1777

These Tables are made by the addition of Secants, so that take what degree of Latitude you please to begin at, as here this Table begins at 50 degrees, let that be your Radius, then look the Secant of 51 deg. in the last line of the Leaf, where you shall find 158.90 (but omitting the 2 last Figures, reckon 159) and set this against 51 deg. and then look out the Secant of 52 deg. which is 162, and add this to 159, it makes 321, and set this in the next Column, and so for the rest of the degrees, as many as you desire.

Thus you shall have the true proportion of these whole degrees of Latitude of this Chart, to the equal degrees of Longitude, as exactly as you need desire.

As for the Minutes, or Centesims of these degrees, (though it will be sufficient to divide each degree into ten parts)

these you shall have exactly cast up to your hand in the Tables, so that you need but turn to the degree you would divide, and there the parts thereof are set down to your hand. As if you would divide the 51 deg. which is between 50. and 51. Turn to the Secant of 51 deg. and there you shall find the several parts thereof ready cast up in this Table.

<i>D.</i>	<i>pts.</i>	<i>pts.</i>
50.	10	16
	20	32
	30	48
	40	64
	50	79
	60	95
	70	111
	80	126
	90	143
51.	00	159

Thus by a larger Decimal Scale you may lay down the whole degrees of your Chart, and then by laying a lesser Decimal Scale; to the beginning of each degree, you may divide your Meridian very neatly, and with much ease.

But

But this will be more exact, especially in Places which have great Latitude; if you make your Table for every half

<i>D. pts.</i>	<i>Seca.</i>	<i>Merid.</i>
50. 00	00	00
50. 50	78	78
51. 00	79	157
51. 50	79	236
52. 00	81	317
52. 50	81	398
53. 00	83	481
53. 50	83	564
54. 00	85	649
54. 50	85	734
55. 00	87	821
55. 50	87	908
56. 00	89	997
56. 50	89	1086
57. 00	92	1178
57. 50	92	1279
58. 00	94	1364
58. 50	94	1458
59. 00	97	1555
59. 50	97	1652
60. 00	100	1752

Degree, and so take out the half Secants, or the Secants of 50 *pts.* setting them half a Degree forwarder than they should be. Thus in this Table, beginning at 50 degrees, which is the Radius set down 00 Secant, 00 Meridian, then for 50 d. 50 *pts.* take half of the Secant of 50 deg. which you shall find at the bottom of the Leaf, against 50 in the margent, which is 78, being half of the whole Secant 156, and set this down against 50 d. 50 *pts.* as you see in this Table. Then for 51 deg. take the half Secant, or the Secant of 50 *pts.* which is 79, and add this to the foresaid 78, it makes 157. Likewise for 51 d. 50, take the half Secant of 51 d. again, which is 79, and add it to the former, it makes 236, and so still use the half Secant twice; as you may see more by the Table.

And thus at last there grows some difference between these two Tables, though but little in every Degree, which by that time it comes to 60 Degrees, is somewhat considerable, the first making the Meridian 1777 *pts.* and this but 1752, which is much the truer; the true parts by Mr. Gunter's Meridian Line being 1755. The degrees being thus set upon your Chart, you may divide them into Minutes, tenths, or 100 *pts.* as before.

If you have any further need of the Meridian Line, either for the making of your Charts, or the casting up of your account thereby, to try how it agrees with these following Rules, you shall have a full and plain Table thereof at the end of the other Tables.

According to these Rules and Tables having made your Chart, they will be a good Help unto you in the keeping of your Account, shewing you still whereabouts you are, and which way you must steer your Course, and when to add or subtract your Latitude or Longitude, as the plain Table did before, being all one in effect, only the Degrees of Latitude are enlarged, according to the Proportion of the Longitude.

And here observe, though I made some use of the table of Secants before, yet now I am to shew you a far more excellent use thereof; which indeed was my chief Intent and Purpose in this present *Treatise*. For here you shall see by these tables of Secants, all the Problemes of Navigation, performed upon *Mercators* Chart, as before they were performed upon the Plain Chart, without any Calculation; having still your Numbers ready cast up for you in these *Tables*.

The excellent use of these Tables of Secants never thus applied by any man before.

As this is that which hath been hitherto wanting, so I hope, being so new and excellent a way, it will be both welcome and profitable to you; Mr. *Norwood* in his *Seaman's-Practise*, hath well explained and applied the first part of these *Tables*, viz. the Table of the Sines; but yet he makes no use nor mention, either of the Tangents, or Secants; not so much as in the plain Table account, in which you see they are of good use, and many Propositions therein cannot well be resolved without them. But for the applying of them to this Chart, I think neither he or any other ever yet thought of it. But herein you shall find them of most excellent use, far beyond the Meridian line ordinarily practised, which cannot be used without Calculation. But as all things that are new and unknown may seem a little hard and difficult at the first, so perhaps the manner of working these Conclusions, may seem at first unto you. But thus much you shall find, that those which are most necessary, are the most easie both for your learning, and for your use; and therefore to encourage you the better, I shall begin with them.

*Proposition 1.*

By the Rhumb and the Distance sailed upon the Rhumb; to find the true Latitude and Longitude, according to the true Sea Chart, in any Latitude.

This



This I know you will grant is the most usual, if not the most necessary Proposition in the practice of Navigation; being the manner of keeping your accounts at Sea, which you call your dead reckoning. And the performing of this by these Tables of Secants, is so plain and easie, that I have little more to say to it, then what I have said already in the former Chapters, concerning the way of keeping this account upon the Plain Chart.

First, you must make the like Table, and use the same way which you did before, to find out the Easting and Westing, the Northing and Southing of your Rhumb, which you must set down likewise in your Table, just as you did before.

Secondly, Likewise by Addition or Substraction of the Northing and Southing, you shall find the true Latitude of the several places, as you did before; But as for the Longitude, as I told you then, the Easting and Westing in your Table, will not shew the true Longitude of those places, unless you be near the Equinoctial, where the degrees of Longitude and Latitude are both of equal length and breadth unto each other.

Therefore in the third place, before you come to turn your Easting and Westing into Longitude, make another Column in your Table, which you may call the Secant Column, in which you shall set down your Easting and Westing, as it ought to be enlarged in the number of deg. or parts of degrees, according to that degrees Latitude which you are in at the present time; And this enlargement of the Easting and Westing, is the work which I shall now most plainly and readily shew you how to find it out, by these Tables of Secants; the manner whereof is briefly thus.

Observe the degree of Latitude in which you have made your course; (which you shall alwayes find ready in your Table, if you sum up your Column of Latitude, as you ought to do) and turn to the said degree in these Tables, and in that Leaf, look down the Margent for the number of your Easting or Westing, which you have set down already in your Tables, and against it in the same line, under the column of Secants, you shall have the true parts of your Longitude enlarged as they ought to be. Which being set down in your Table of account, in the column of Secants, they may

be



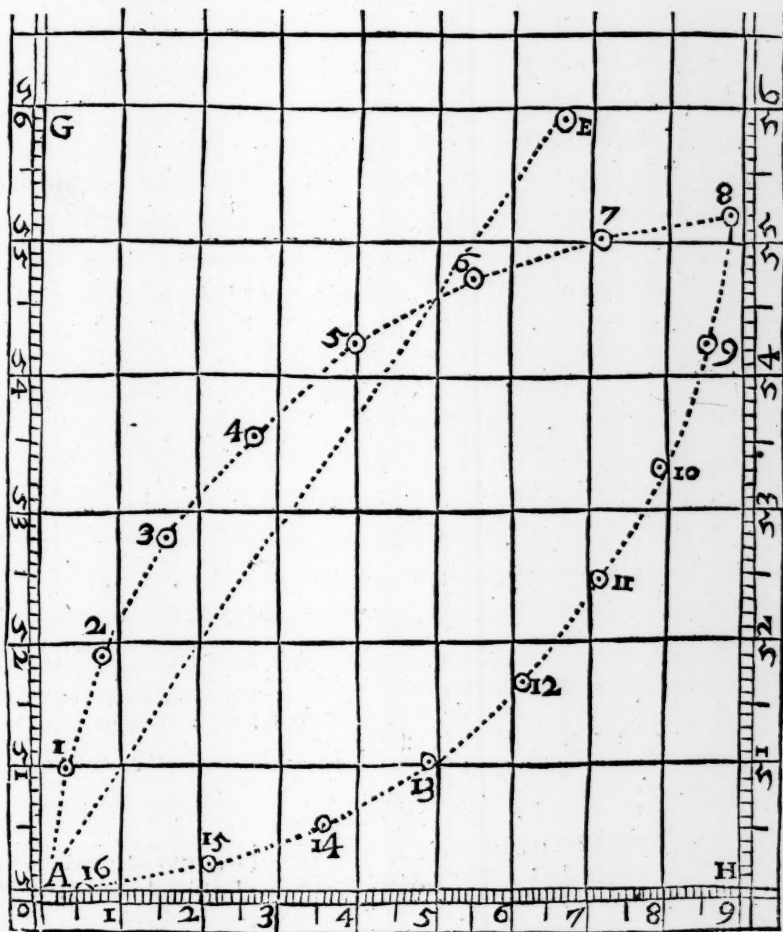
be afterward added or subtracted, as the Easting or Westing of the Longitude requires, and so set down as you see them in the column of Longitude, by this means your Table of account shall be made very true and perfect, shewing you the true Longitude and Latitude of the place where you are at any time, which you may prick down upon any Chart, Map, or Globe, and so know exactly where you are, and which way to shape your course, to what ever place you intend to go.

This Table of account and the following Chart, will make all as plain as may be.

The places.	The Course.	diffa. D. pts	Nor. D. pt.	Sou. D. pt.	East D. pt.	West D. pt.	Latit. D. pt.	Seca. D. pt.	Long. D. pt.
From A.	d.						50 00		00 00
from A to 1.	NE 10	1 00	98		17		50 98	0 27	00 27
from 1 to 2.	NE 20	1 00	94		34		51 92	0 55	00 82
from 2 to 3.	NE 30	1 00	87		50		52 79	0 81	01 62
from 3 to 4.	NE 40	1 00	76		64		53 55	1 06	02 68
from 4 to 5.	NE 50	1 00	64		76		54 19	1 29	03 97
from 5 to 6.	NE 60	1 00	50		78		54 69	1 48	05 45
from 6 to 7.	NE 70	1 00	34		94		55 03	1 64	07 09
from 7 to 8.	NE 80	1 00	17		98		55 20	1 71	08 80
from 8 to 9	SW 10	1 00		98		17	54 22	29	08 51
from 9 to 10.	SW 20	1 00		94		34	53 28	56	07 95
from 10 to 11	SW 30	1 00		87		50	52 42	81	07 14
from 11 to 12	SW 40	1 00		76		64	51 65	1 04	06 10
from 12 to 13	SW 50	1 00		64		76	51 01	1 21	04 89
from 13 to 14	SW 60	1 00		50		87	50 51	1 35	03 54
from 14 to 15	SW 70	1 00		34		94	50 17	1 46	02 08
from 15 to 16	SW 80	1 00		17		98	50 00	1 52	00 56
from 16 to A.		0 36				56	30 00	0 56	00 00

In this Table and Chart you may see that the Port you sail from is supposed to be at A, having 50 deg. of Latitude, and 00 degrees of Longitude; and from hence suppose that the first day you sail North-Easterly, upon an angle of 10 deg. which is almost North by East, to the distance of one degree, or 100 parts, and you find by the Table of Sines (as before) that the Northing of this course and distance

# A Figure of the true Sea-Chart.



Note this well, for here is all the difference of work between these two Charts, which shews the Longitude exactly, & is most easily performed by these Tables of Secants.

stance is 98 *C. pts.* and the Easting thereof is 17 *C. pts.* which must be set under the Columns of North and East. Now this Northing added to the fore-said Latitude of the place A, which was 50 deg. makes the Latitude of the place you are in 50 deg. 98 parts, or almost 52 deg. as the column of Latitude shews. \* But now for the Longitude you must not reckon your self to be in 00 deg. 17 parts; but turn to the degree of the Latitude you have sailed in, being between 50 or 51, but rather take that degree which is nearest (rather most Northerly) being 51, and in that Leaf, against the number of your Easting, which is 17 parts, you shall find that the Secant thereof is 27 parts. This 27 parts is the true difference of Longitude enlarged, which you must set down in your Table of account, in the Secant column, and this added, to the Longitude of A, makes the true Longitude of this place to be 00 deg. 27 parts.

And thus also for the second day and course, which is NE 20 deg. suppose you sail one degree or 100 parts more. The Northing of this is 94 parts, and the Easting 34 parts. This Northing added to the former days Latitude, makes the Latitude you are in 51 deg. 92 min. And therefore turning to this degree of 52, in the Table of Secants, you shall find there, that your 34 parts of Easting, makes 55 parts of Longitude, which added to the former Longitude, makes the Longitude of this place 00 deg. 82 parts, and so you must do for all the rest.

And thus you see this troublesome business of proportioning the degrees of Latitude and Longitude, is most readily and exactly performed by this Table of Secants; far beyond any other way of the Meridian line; which cannot be used without the Rule of Proportion; and in most cases (specially in such small distances) as exact as any way of Calculation need be.

And if you reckon your Ships way, thus in degrees and hundred parts, as the Tables are fitted for it; you shall have the most ready and exact way of keeping your account true and perfect, according to the Globe, and round body of the Earth and Sea, that ever was, or can be invented.

This Table of account and the following Chart, will make all as plain as may be.

The places.	The Course.	dista. D. pts	Nor. D. pt.	Sou. D. pt.	East D. pt.	West D. pt.	Latit. D. pt.	Seca. D. pt.	Long. D. pt.
From A.	d.						50 00		00 00
from A to 1.	NE 10	1 00	98		17		50 98	0 27	00 27
from 1 to 2.	NE 20	1 00	94		34		51 92	0 55	00 82
from 2 to 3.	NE 30	1 00	87		50		52 79	0 81	01 62
from 3 to 4.	NE 40	1 00	76		64		53 55	1 06	02 68
from 4 to 5.	NE 50	1 00	64		76		54 19	1 29	03 97
from 5 to 6.	NE 60	1 00	50		78		54 69	1 48	05 45
from 6 to 7.	NE 70	1 00	34		94		55 03	1 64	07 09
from 7 to 8.	NE 80	1 00	17		98		55 20	1 71	08 80
from 8 to 9	SW 10	1 00		98		17	54 22	29	08 51
from 9 to 10	SW 20	1 00		94		34	53 28	56	07 95
from 10 to 11	SW 30	1 00		87		50	52 42	81	07 14
from 11 to 12	SW 40	1 00		76		64	51 65	1 04	06 10
from 12 to 13	SW 50	1 00		64		76	51 01	1 21	04 89
from 13 to 14	SW 60	1 00		50		87	50 51	1 35	03 54
from 14 to 15	SW 70	1 00		34		94	50 17	1 46	02 08
from 15 to 16	SW 80	1 00		17		98	50 00	1 52	00 56
from 16 to A.		0 36				56	30 00	0 56	00 00

*Proposition 2.*

By the Course and difference of Latitude, to find the true difference of Longitude.

This is the second question necessary in keeping your account; for hereby you must correct your dead reckoning, when the Latitude thereof doth not agree with your Latitude by observation. And herein, as I told you before, there are two cases, the one, when you have failed only upon one Rhumb: the other, when you have failed upon two or more several Rhumbs.

If your correction be in respect of one Rhumb; mark what Rhumb it is you have failed upon, and turn to the degree thereof in the Tables, then look down the Margent of that Leaf, and there find the difference of Latitude

K

which

which is between your dead reckoning and observation, and in that line in the Table of Tangents, you shall have the Easting or Westing belonging to the said difference of Latitude upon that Rhumb, as before in the use of the Plain Chart.

Let this difference of Latitude be added or subtracted to the Northing or Southing in your Table of account, as the occasion requires, Likewise let the Easting or Westing, be added or subtracted to the Easting or Westing of your account: your Northing being thus corrected, and set into the column of Latitude, shall without any farther trouble, shew you the true Latitude of the place you are in; But your Easting or Westing must be first enlarged, according to the Latitude you are in, by the rules of the former Proposition, and so shall shew you the true Longitude, being added or subtracted to the Longitude of the former account, as you must cast it up all along your Voyage.

For example, suppose you sail from A, whose Latitude is 50 deg. and Longitude 20 deg. upon the third Rhumb, or angle of 34 deg. toward the *NE*, according to your dead reckoning about the distance of one degree or 100 parts, which is at the point B; your Latitude and Longitude will be according to your account by these foresaid rules, Latitude 50 degrees, 83 parts, Longitude 20 deg. 87 parts, as in this Table.

	Dist.	North	East	Latit.	Secan.	Longit.
The place A				50 00		20 00
NE 34 d.	100	83	56	50 83	0 87	00 87
	21	17	11	51 00	0 17	21 04

Now suppose that making a fair observation of the Latitude, you find your self to be just in 51 deg. whereas by your account you thought your self to be but 50 deg. 83 parts, here is a difference of 17 parts of Latitude. And as you are gone farther in Latitude, so you must go further in Longitude also then your account shews for, which you desire to know exactly. First, therefore you must correct your Northing and Easting, by the Tangent of the angle of the Rhumb 34 degrees, which will allow for the 17 parts of



of Latitude 11.47 parts of Easting: So you must set in your Table of account 17 parts under the North column, and 11 parts under the East column. This 17 parts of Northing added to your former Latitude 50 deg. 83 parts, makes it just 51 deg. of Latitude. Now to find the Longitude belonging to these 11 parts of Easting, you see you are come to 51 deg. of Latitude, turn therefore to 51 degrees in your Tables, and there against 11 in the Margent, you shall find the Secant to be 17.48, for which you may set down only 17 in the Secant column, and this added to the former Longitude, which was 20 d. 87 parts, makes it 21 deg. 04 parts, and this is the true Longitude of the place you are in.

Also the Secant of this angle 34 deg. shews the distance run, which is 21 pts. fere.

This I account the best way of correcting your account, working only by the difference of Latitude which you find between your dead reckoning and observation; and not by the whole difference of Latitude which you have sailed, especial if it be any thing a great distance exceeding 4 or 5 degrees: for in this case, in regard every degree of Latitude doth alter somewhat from another, it will be more trouble because you must work by the middle Latitude, and that sometimes will not be so exactly performed as you may by your Ruler upon a Chart that is truly made, and hand-somely delineated.

And therefore now I come to this second case, wherein you may be supposed to have made a farther progress in your Voyage, and have sailed upon several Rhumbs, and not have opportunity to make observation of the Latitude before, and now find some difference between your account, and observation of the Latitude; In this case as I told you before in the use of the plain Chart, so here also by the difference of Longitude and Latitude, you must find the Rhumb between this first and last place of your account. This you may do by these Tables, as I shall shew you in the next Proposition; but it will be better to save the labour, and only to draw a line in your Chart between the two places, and to find the angle of the Rhumb between them with your Compasses: which you may do as exactly (yea, perhaps more exactly when the distance is any thing great) as you can by these or any other Tables of Meridional parts, I am sure far more readily.



\* In the  
third  
Proposition of  
Plain  
Sailing.

The reason of this finding the Rhumb between the two places I shewed before, \* therefore I shall not here repeat it, though it be many times of much concernment in your account, and therefore not to be neglected, especially when you are forced to any great alteration of your Rhumb.

Having found the Rhumb between the two places, work by this angle, and the difference of Latitude between your account and observation; finding first the Easting or Westing belonging to that difference of Latitude; and then by the parts of Easting or Westing, find the enlargement of them, according to the Latitude you are in, as I shewed before by the Table of Secants; Thus this difference of Latitude being added or subtracted to your account of Latitude, and this difference of Longitude being likewise added or subtracted, to your account of Longitude you shall have the true Latitude and Longitude of the place you are in. Provided that you are not driven out of your way by some unknown Currents; as I shewed at large before.

An example of this I count needless, being in effect the same as before; when you have once found the Rhumb between the two places.

And thus these two Propositions: 1. How to keep your account both of Longitude and Latitude? 2. How to correct your account both in Longitude and Latitude? being the most useful and necessary Propositions in Navigation, are most easily and readily performed by this Table of Secants in all Latitudes whatsoever, without any calculation with the Meridian line, which requires more trouble and labour, first in finding the parts of the Meridian between the two Latitudes; and then when you have found them, you must resolve your question by the Rule of Proportion.

*Proposition 3.*

How to allow for Currents in your accounts.

By what I said before concerning Currents, it is manifest that for the most part they drive the Ship out of the course you reckon upon, both in respect of Longitude and Latitude, therefore if they be known (by some former observation

vation or other means) which way, and how fast they run ; it will be very good to allow for them in your account, which will be much more perfect thereby.

This allowance may be inserted into your account either every day, or once in three or four days, according to the Northing and Southing, Easting and Westing thereof, as I shewed before in the Chapter of Currents ; which Northing and Southing shews the Latitude in all places, without farther trouble ; But for the Easting or Westing you must make an enlargement thereof, according to the Latitude you are in, as I shewed in the last Proposition, if your difference of Latitude be not much, which will be when you make this allowance every day ; or sail upon a course near the East or West. But if you let your account run for three or four days, without allowance, so that your difference of Latitude be 4 or 5 degrees, or more, then you must make your enlargement of the Longitude, according to the former Rules by the Table of Secants, but you must not work by the Latitude you are come to, but by the middle Latitude between the two places, for so your Longitude shall be more exact, as you shall see more in the next Proposition.

Thus if you were to sail from *Cape-Race*, or some part of *New-Found-Land*, having Latitude 50 deg. and Longitude 330 deg. the Current running 20 C. pts. North-East every day, you may frame your account thus, allowing for the Current (as it is best) every day, or upon every alteration of your course.

	Course	Dist.	North	South	East	West	Latit.	Secat.	Longit.
<i>New-found land</i>	d.						50 0		330 0
The first day	NE 10	100	98		17				
Current.	NE 45	20	14		14				
			12		31		51 12	49	330 49
The 2 day	NE 20	100	94		34				
Current.	NE 45	20	14		14				
			10		45		52 30	78	331 26
The 3 day	NE 30	100	87		50		53 07	83	332 09
The 4 day.	NE 40	100	76		64		53 51	109	333 18
The 5 day.	NE 50	100	64		76		54 47	129	334 47
Current.									
for these 3 days	NE 45	60	42		42		54 59	71	335 18

By

This Table is ineffect all one with the former, only the degrees of Longitude are changed, but the difference of Longitude would be the same, were it not for the supposed Current.

By this Table you may see plainly how to allow for the motion of the Current in any Latitude, either every day, or once in three or four days; and by comparing this with the former, you may see what difference such a Current may make in your course in a little time; for whereas by that Table, in five dayes time you should be in 54 deg. 19 parts of Latitude, and 3 deg. 97 parts of Longitude, which is at F upon the Map; By this Table you see you are come to 54 deg. 90 parts of Latitude, and 5 deg. 18 parts of Longitude, which is at D upon the Map. So that the difference of Latitude is 69 parts, and the difference of Longitude is 1 deg. 21 parts, in the said five days time. So that this is a thing very considerable, and good use may be made thereof, if the true course and swiftness of Currents were known, and therefore as they are by all care and diligent comparing of your course outward & homeward indeavoured to be found out; so being found I could wish they were made more publick for the general good.

*Proposition 4.*

By the knowledge of the Latitude, and Longitude of two places, to find the Rhumb, and also the distance between them, upon the said Rhumb.

This Proposition admits of three several Cases.

This first is when both places have one and the same Meridian, and difference only in Latitude.

The second is when the two places have one and the same Latitude, and differ only in the Longitude of their Meridians.

The third case is when the two places differ both in Latitude and Longitude.

And each of these cases may have two or three varieties, viz. 1. One or both places being under the Equinoctial. 2. One or both places being to the North or South of the Equinoctial. 3. One place being to the North, and the other to the South of the Equinoctial.

But these varieties many of them are not so proper to be resolved by this Chart, as by the Doctrine of Spherical Triangles,

Triangles, here we shall only speak of places which have no great distance, they being best resolved by these Rules.

For the first of these Cases, If two places have one and the same Meridian, and differ only in Latitude: then the Rhumb between them must needs be North, and South, and the difference of Latitude, is the true distance between the two places, let them be in what Latitude they will. For though the degrees of Latitude in the Chart do seem to encrease, and grow longer toward the Poles; yet they are all of one length, *viz.* about 20 Leagues, or 60 Miles and that enlargement of them in the Chart, is only in respect of the degrees of Longitude; which though they seem (on the contrary) to be all of equal breadth, yet grow less and less toward the Pole, one deg. in the Latitude of 60 deg. being but 10 Leagues or 30 Miles, which is but half a degree in the Equinoctial.

So that let the one place be A in the Latitude of 50 degrees, and the other in the Latitude of 55 deg. under one and the same Meridian, or line of Longitude; the course between them is North, and South, and the distance is 5 degrees, according to the difference of Latitude between them: which makes 100 Leagues, or 300 Miles.

For the second case, when both places have one and the same Latitude, but differ only in Longitude; then the Rhumb between them must needs be East and West: But the distance is not according to the degrees of Longitude (as before) but bears a proportion to the Cosine of the Latitude.

So that as the Radius;  
To the Cosine of the Latitude.

So their difference of Longitude in degrees and parts,  
To their distance in degrees and parts.

This may best be found out upon the Chart thus, Open your Compasses to half the distance between the two places, and setting one foot of your Compasses in the common Latitude of the two places. Mark how far the other Foot will reach both above, and below it, upon the Meridian Line, and

and the Degrees of Latitude between these two points, will be the Distance; (or very near) between the two places.

But this may be far more easily performed by these Tables, as thus; First, turn to the Degree of Latitude which the two places are in, and find in the Margent the Degrees of the difference of Longitude between the two places, and in that Line in the Table of Sines, under the said Latitude of the Places, you shall have the true distance in degrees and parts.

Thus let the two places be A and H, both in the Latitude of 50 degrees, and let their difference of Longitude be 9 deg. turn to 50 deg. in the Tables, and against 9 in the Margent, under the Sine of 50 deg. you shall have 5.79, which shews the distance between the two places is 5 deg. 79 parts, which is 116 Leagues *ferè*, or 347½ Miles *ferè*.

Or else let the two places be G and E, both in the Latitude of 56, and their difference of Longitude 6 deg. 75 parts. Turn to 56 degrees in the Tables, and under the Sine of 56 deg. you shall find thus;

For six degrees of Longitude	3 deg. 36 parts.
For 75 parts of Longitude	0      42

Which added, shews their distance 3      78

Which makes 76 Leagues or 227 Miles *ferè*.

The third Case is, when both the places differ both in Longitude and Latitude.

This is the most usual Case, but yet let me tell you, that this Question may with more ease, and as much exactness, be resolved upon your Chart with your Ruler and Compasses, as by these or any other Tables of Meridional Parts; especially when the distance is any thing large, I mean about 4 or 5 degrees. And therefore I shall rather advise you to use that way, and to follow the Rules to this purpose, in my *Geometrical Sea-man*, especially in finding the Rhumb between the two places, which as it may most readily be found out thereby, so if you have any care, you may find the Rhumb as exactly as you need, or can steer your Course to any place.

But



But that you may see here is no defect in these Tables, in this particular, more than in any other, the way of work is thus, which is ready enough, being well understood, and a little practised.

Suppose the two places to be A and E, A in the Latitude of 50 deg. and E in the Latitude of 56 deg. and the difference of Longitude between them is six degrees, 75 parts. Now it is desired to know the Rhumb, and the Distance between those two places.

#### First for the Rhumb.

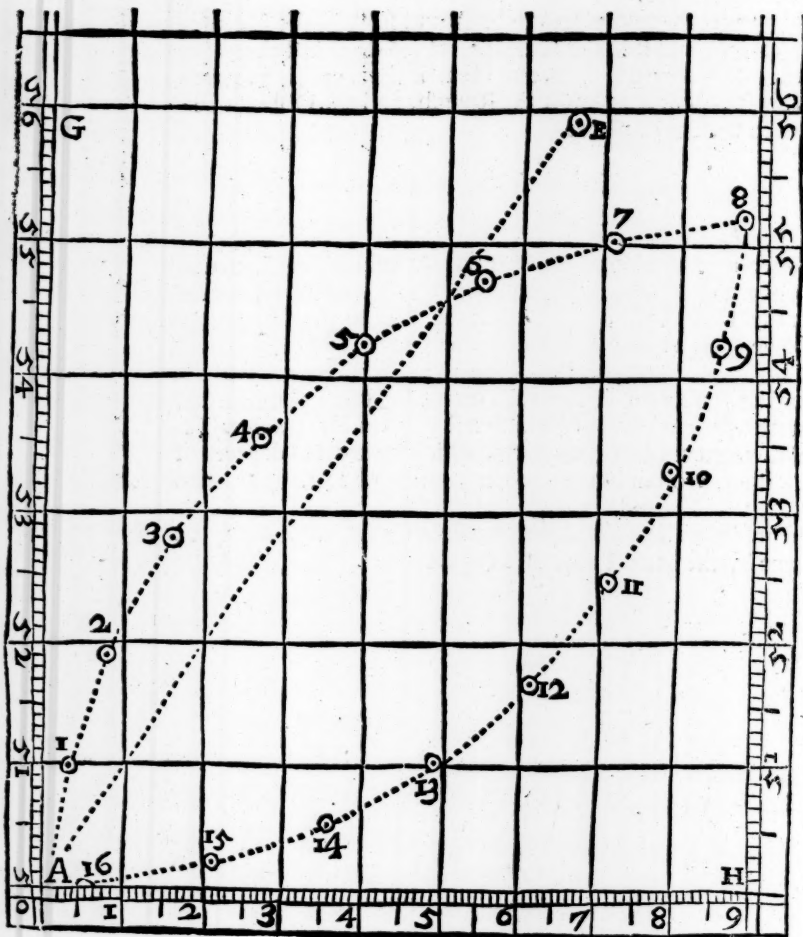
*First*, Consider the several Latitudes of the two places, which is 50 deg. and 56 deg. and take the middle Latitude between these two, which is 53 deg. Turn to this degree in the Table, and there find the true difference of Latitude in the Margent, which is 6 degrees, and against it in the Table of Secants, you shall find 9.97, that is 9 deg. 97 parts, for the difference of Latitude enlarged, which you shall find much as one with your Meridional parts in Mr. *Gunters* Table, which are 9 deg. 99 parts, which makes the degrees of Latitude proportionable to the degrees of Longitude, and with this Latitude enlarged you must find your Rhumb, as before in the like Case upon the Plain Chart, which may be done by the little Table of Tangents.

U

A



## A Figure of the true Sea-Chart.



As the Latitude enlarged	9 deg. 97 parts
To the degrees of Longitude	6 75
So is the Radius	10000
To the Tangent of the Rhumb	6770.
Which is the Tangent of 34 deg. 10 parts.	

Or else thus by these Tables, find 9 deg. 97 parts, or 10 degrees (which it comes to very near) in the Margent, and turn over the Tables, till you find 6 deg. 75 against it in the Table of Tangents; this you shall find exactly at 34 degrees, so that you may conclude this is the angle of the Rhumb between the two places, being much about the third Rhumb from the Meridian, which is 33 deg. 45.

*Now for the distance of the 2 Places.*

The Rhumb being thus found, the distance is much more readily found; For you need only find the true difference of Latitude, which is 6 degrees in the Margent, and the Secant against it, under this angle of the Rhumb 34 deg. is 7.24, which shews the distance of the two places, to be 7 deg. 24 parts, that is 145 Leagues *ferè*, or 434 Miles and an half *ferè*.

If you will perform this by Calculation, use either of these ways.

As the Cosine of the Rhumb Cos. 24.10	8281
To the true difference of Latitude 6 deg.	6 deg. 00
So is the Radius	10000
To the distance required	7 d. 25

Or else somewhat better consider the former work, and more agreeable to these Tables.

As the Radius	10000
To the difference of Latitude	6 d. 00
So the Secant of the Rhumb 1 Sec. 34.10	12076
To the distance	7 d. 25

I might here make a shew of many more Propositions, by varying some of these; but these contain all others, and in your keeping of your account, there will be no need of others at all, neither of any other way of performance of them, this being the best and plainest, and therefore I will not trouble you with any other.

## CHAP. VII.

### *Of Sailing by a Great Circle.*

**T**HAT which I have said in my *Geometrical Sea-man* concerning this subject is so plain and practical, that I am confident there can be no better way to perform those Propositions; And therefore I count it needless to speak any thing hereof: especially since, when you have found out the way of the Great Circle according to its Latitudes and Longitudes, you must thereby set it into your Chart, and so keep your account by Rhumb and Distance, according to the rules aforesaid.

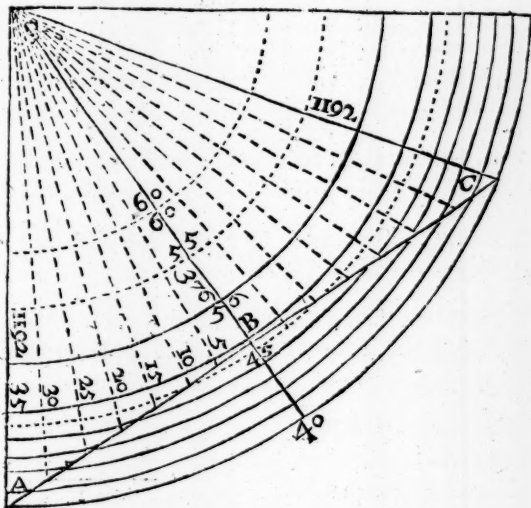
Yet because some that are more curious in these Arts, may not think that way exact enough, because in some cases the Tangent line either will not be large enough toward the Pole to shew the difference of Latitudes, or towards the Equator is too large: and because others may doubt of the truth of the performance, (though there be no ground of exception to be made against it by any Artist in that particular, therefore to satisfy both the one and the other, I shall shew you how to perform these conclusions by these Tables, so that they may find the Latitudes of the Arch of the Great Circle, as exactly as they please, to Minutes, or hundred parts of a Degree. And for the demonstration of the truth thereof I shall not perform these Conclusions, as (others use to do) by Spherical Triangles, but reduce them into plain Triangles, supposing the sides thereof to be Tangent lines, by which way the work of Calculation will be more plain and easie, and the truth of the foresaid Geometrical way fully demonstrated.

*Pro-*

## Proposition 1.

To find the Latitudes and Longitudes of the Arch of a Great Circle, for a parallel course.

Let the Example be the same as in my *Geometrical Seaman*, suppose two places, in the parallel Latitude of 40 degrees, and let their distance of Longitude be 70 degrees, and it is desired to know the Latitudes of the Great Circle, for every fifth degree of Longitude?



These Circles are drawn by the Tables of Natural Tangents; counting the Latitudes by their complements from the Pole or Center P.

Let the two places be set upon the Instrument, or upon such a part thereof as this here; wherein P represents the Pole, A and C are the two places in the Parallel of 40 degrees, being 70 degrees of Longitude from each other. Now I say, a part of the great Circle passing by these two places, is the straight Line ABC, drawn from the one place to the other, which as it crosseth the Parallels of Latitude, at the several degrees of Longitude, shews the true Latitudes and Longitudes of the said Circle from the Equator.

Now

Now for the proof of this, and also the more exact finding of the Degrees and Minutes of Latitude : Let this Triangle  $APC$  be considered as a plain Triangle, the two sides whereof  $AP$  and  $PC$ , are 50 degrees, being the Complement, of the Latitude of these Places from the Equator ; now these sides being natural Tangents, take the Tangent of 50 deg. (out of the little table of Tangents) which is 1192, and this is the length of either of the sides  $AP$  or  $CP$ . Thus you have two sides of this Oblique Triangle, and the Angle between them at  $P$ , which is 70 deg. the difference of their Longitude.

In the next place you must reduce this oblique triangle  $APC$ , into two right angles, by letting fall the perpendicular, upon the point  $B$ . Now this is easily done, in this parallel Question, by dividing the foresaid Angle of Longitude 70 in half, which is 35 deg. and thus you have two right angled Triangles,  $APB$ , and  $CPB$ , all whose angles are known, and the Hypothenusals, which are alike in both the Triangles, so that the resolution of the one will serve for the other.

Thirdly, By these things known, you may find the length of the perpendicular  $PB$ , by the first case of plain Triangles. For if you turn to the angle at  $P$ , which is 35 deg. and find the Hypothenusal side  $AP$ , 1192 in the Margent, you shall find in the Table of Sines ; For the Perpendicular  $PB$  976.37.

For 11.00	Perpendicular	09.01
For 00.92		75.37
Which added makes		<u>976.37</u>

Now look these Numbers in a Table of Natural Tangents, you shall find the Perpendicular  $PB$  is 44.31 *C. pts.* or 19 min. Now this Perpendicular side being 44 deg. 19 from the Pole  $P$ , the complement thereof is the greatest Latitude of the Great Circle from the Equator, which is 45 deg. 49 min. or 69 parts.

Fourthly, If you leave out the two last Figures of the Perpendicular as being of little value, and account the line  $PB$  to be only 976, maketh this your Radius, and so the  
pricked

pricked lines from the Pole P, to the line of the Arch B A or B C, will be so many Secants, in proportion to the said Radius, according to any Angles of Longitude you please, which need not be above every fifth degree of Longitude, as they are here pricked out. And now if you turn to these angles of Longitude in your Tables, and find this Radius 976 in the Margent, the Secant against it will give you the true length of the lines from P, which are all one as I said before on both sides the perpendicular B.

Thus for the line P 5, the Angle at P is 5 deg. and the Radius 976, turn to the Table of 5 deg. you shall find,

For 97.0 The Seca. is 97.37 } which is the tang. of 44.21 pts.  
For 00.6 60.2 } whose compl. is 44. 59 pts.

which added makes 97.97.2 } which is the latitude for that longitude.

Thus for P 10, the angle at P being 10 degrees find the foresaid Radius 976, in that Leaf of the Tables, belonging to 10 deg. and you shall have,

For 97.0 The Secant is 98.49. The tangent of 44 d. 74 pts.  
For 00.6 60.2 whose comp. is 45 26

99.09.9 the latitude for this longitude.

And so for the other Lines according to their several angles.

		<i>d. pts.</i>		<i>d. pts.</i>
For P 5	Secant 101.04	Tang. 45.30	Lat. Arch	44.76
For P 20	Secant 103.87	Tang. 46.09	Lat. Arch	43.91
For P 25	Secant 107.69	Tang. 47.12	Lat. Arch	42.88
For P 30	Secant 112.69	Tang. 48.42	Lat. Arch	41.58
For P A	Secant 119.14	Tang. 50.00	Lat. Arch	40.00

And thus by these Tables you have the chief thing which is needful in your Sailing, *viz.* the Longitudes and Latitudes by which the Arch of the Great Circle doth pass between these two places. As for the angles of Position and the distance, they are little to the purpose, only to help to find out these Longitudes and Latitudes of the Arch, in the ordinary way of Calculation. And though I have been somewhat



somewhat long, endeavouring to make every thing plain for young beginners, yet the thing of it self is of more easie and speedy performance, then any Calculation by Logarithmes.

And yet because the distance between places seems a thing very desirable. First, if you please you may find the distance of these two places, by the rules of the last Chapter, finding the difference of Longitude of these places being 70 deg. in the Margent of these Tables under the Sine of 40 deg. which is their Latitude, for so their distance is 53 deg. 62 parts.

Lastly, it may be performed by these brief Tables of Natural Sines, and that with as much ease, as by the Logarithms, according to this proportion.

As the Radius

To the Sine of half the differ. long.	35 deg.	5736
So the Cosine of the common lat.	Cosine 40	7660
To the Sine of half the distance	26.07	4392

Turn to the degree of the Latitude, (because the Sines are inverted) whose Sine is 76.60, and there find the Sine of 35 deg. which is 5736 at twice in the Margent, so you shall have 4392, whose Sine is 26 deg. 07 parts, which is half the distance, this doubled is 52 deg. 14, which is the whole distance.

The work is briefly this, under the Sine of 40 deg.

For 57.00 in the Margent, the Table yields	4366
For 00.36 in the Margent, the Table yields	2757

439357

Which cutting off the two last Figures may be as before. 4394

*Proposition 2.*

How to find the Longitude and Latitudes belonging to the Arch of a Great Circle between two places which differ both in Longitude and Latitude, lying both upon the one side of the Equator.

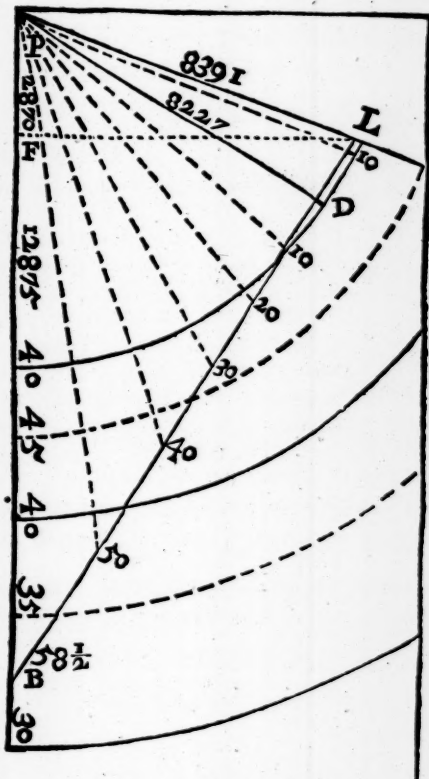
Let the two places be the *Bermudas* or *Summer-Islands*, whose Latitude is 32 deg. 25 min. or 41 parts, and the *Lizard* in the Latitude of 50 deg. and their difference of Longitude

gitude 70 deg. and it is desired to find the Latitude of the Great Circle at every fifth deg. of Longitude between them.

First set the two places upon the Instrument in my *Geometrical Sea-man*, or in some such Figure as this, according to their Longitudes and Latitudes, the *Bermudas* at B, the *Lizard* at L, and P represents the Pole of the World.

Here now you have a Triangle, whose sides are know, viz. P B the Tangent of 57 deg. 95 parts 15745, and P L the Tangent of 40 degrees 8391, (being the co-tangents of the Latitude of the two places) and the angles between them being 70 degrees.

Now here you might save much labour, if with the Ruler and Compasses, you would let fall the perpendicular, or draw the line P D squarewise to the line B L, which will fall about 11 deg. and an half form L, and 58 deg. and an half from B. Otherwise you must be forced first to let fall a perpendicular from L, upon the line P B, and thereby find the perpendicular P D, which must do the chief



This Figure is also drawn by the Table of Natural Tangents.

chief business, being the Radius for the Secants of the Arch.

Yet this may be done as well by these Tables, as by any others, for if you work according to Spherical Triangles, the very same things must first be found out, and require as much trouble.

First, therefore for the perpendicular LF, and the side PF, you have the angle at P 70 deg. and the Hypothenufal PL, the Tangent of 40 deg. 8391, by which according to the first case of Plain Triangles, turn to the Sine of 70 deg. in the Tables, and there in the Columns of Sines finding the foresaid number at twice in the Margent.

For 83.00	78.00	28.29
00.91	85.51	31.12

So the Perpendicular is 78.86 and the side 28.70

This 2870 being the side PF, and being subtracted out of the whole side PB, which was 15745, there remains 12875 for the side FB, with which, and the perpendicular side LF, you may find the angles of this right Triangle LFB, and also the side BL if need were.

For look over these Tables, and find one of these sides in the Margent, and the other in the Tangents, you shall find them fall between the Tangents of 31 and 32, and 59 and 58 degrees. For if instead of the number 7886, you take 7900 somewhat near it, and so look out 79 in the Margent, till you find some Tangent number which shall come near the other number 12875, you shall find,

under 59 deg. The tangent is 131.48 The Seca. 153.39  
and under 58 deg. The tangent is 126.43 The Seca. 149.08

The sum makes	257.91	302.47
---------------	--------	--------

The half or middle is	128.95	151.23
-----------------------	--------	--------

Which comes very near the appointed Numbers.

If you will find this angle at B more exactly, use this proportion;

As the side FB	12875
To the side LF	7886
So is the Radius	10000
To the tangent of the angle B	6125
Which is the Tangent of	31 d. 49 p <sup>ts</sup> .

Having



Complement is 50 deg. 56 parts, which is the greatest Latitude of this Great Circle.

And thus this oblique angle B P L is divided into two right angles, by this perpendicular P D, all whose sides and angles are known, most of which labour might have been spared, by drawing this line with your Ruler and Compasses, so you might have found the one angle at P to be 58 deg. and  $\frac{1}{2}$ , and the other to be 11 deg.  $\frac{1}{2}$ , the whole being 70 degrees.

Either of these ways having found these angles, you must consider how these angles of Longitude have relation both to the places B or L, and also to the perpendicular P D, and set them down in a Table that so you may find the angles which the desired degrees of Longitude make with the perpendicular. Then according to the Radius of the perpendicular, which here is 8227, seek the several lines from P to the line L B according to their angles with the perpendicular, which lines are only the Secants of the said Radius, and therefore I call them Secants in the Table, and these Numbers being found out in a Table of Tangents, will shew you the several distances of the Circle from the Pole, whose Complements are the Latitude of the said Arch in those Longitudes.

Thus you have all things that are necessary for the description of this Arch upon your Chart, according to the Longitudes and Latitudes thereof. As for the angles of position, they are of no use at all, it being better to look after the Rhumb, which this Circle makes upon your Chart. But the nearest distance between these two places seems a thing more needful to be known, which though the line B L between the two places being 15100, will not shew it truly, though it be measured either way in the Tangent line; yet by what hath been done, you are in a good forwardness to attain the knowledge thereof, according to the ordinary rules of Spherical Triangles.

The angles of longitude from B.		The angles from the perpendicular P D.		Secants to the Rad. 8227	The Tang. of the numbers.	The comp. shew- ing the latitude of the Arch.		
o d.	o pt.	58 d.	50 pts		57 d. 5 <sup>s</sup> pts	32 d.	42 pts	25 m.
5	o	53	50	15745		35	86	52
10	o	48	50	13833	54 14	35	85	51
15	o	33	50	12417	51 15	41	40	24
20	o	48	50	11343	48 60	43	57	34
25	o	33	50	10513	46 43	43	57	34
30	o	28	50	9861	44 60	45	40	24
35	o	23	50	9363	43 12	44	88	53
40	o	18	50	8972	41 90	48	10	06
45	o	13	50	8676	40 95	49	05	03
50	o	08	50	8466	40 25	49	75	45
55	o	03	50	8306	39 71	50	29	17
				8243	39 50	50	50	30
The		Perpendicular.		8227	39 44	50	56	34
60		1	50	8230	39 45	50	55	33
65		6	50	8280	39 63	50	37	22
70		11	50	8351	40 00	50	00	00

For in the letting fall the first Perpendicular from L to F, you found the side P F to be 2870, which is the Tangent of 16 deg. 1 part, and this subtracted from the whole side P B the complement of the greater Latitude 57 deg. 59 parts, there rests 41 deg. 58, for the side F B.

Thus the first part of the operation is performed.

The second is thus, which you may best perform by the Logarithm Sines, it being to be all wrought by Sines.

As the Cosine of P F Cosine 16 d. 01 com. Ar. 0,017158

To the Cosine of F B Cosine 41 58 pts. 9,873915

So the Cosine of P L Cosine 40 00 pts. 9,884254

To the Cosine of the dist. B L Cosine 53.47 parts 9,775332



## Proposition 3.

When two places are so situated, that the one is under the Equinoctial, and the other toward one of the Poles, having difference of Longitude and Latitude: how to find out the Longitudes and Latitudes of a great Circle between them?

The first example when the two places differ just 90 deg. in Longitude.

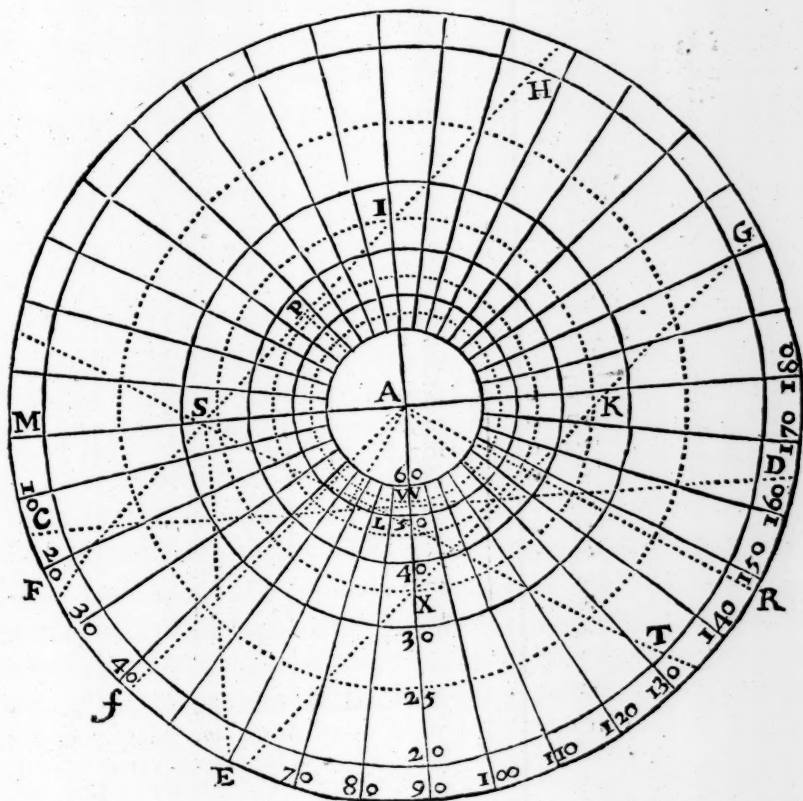
If the place differ just 90 deg. in Longitude, the work will be very plain and easie. For you must make the Tangent of the Latitude of the place your Radius, and then the Secants agreeable to that Radius, according to their several angles of Longitude, will be the Tangents of the Latitude from the Pole.

Thus in the Figure following let S represent the Summer Islands according to the Longitude and Latitude thereof; the pricked line S E drawn from hence at right angles with the line A S, represents a part of the Arch of a great Circle, toward a certain place under the Equinoctial, whose difference of Longitude from S is just 90 deg. Now as this line S E shews the Latitudes and Longitudes of this Arch according to the largeness of the said Radius, and as far as the projection will give leave, so it shews a most plain way for the Calculation thereof, when you require more exactness.

For here it is plainly visible to you, that the Co-tangent of the Latitude, or the distance of S from the Pole A, must be the Radius, and then that the several lines of Longitude drawn from the Center A to this line S E, are the Secants of the said Radius according to the angles of Longitude, which measured by the Circles in the Figure, or the Tangents of Latitude in the Tables, shew the Co-tangents of the Latitudes of the said Arch, according to the Longitude desired. So that this proportion will hold good.

*This*

This is a Projection of almost one half of the Globe in plano, wherein the Center represents the Pole, the Circles are the parallels of latitude, which are drawn by a line of natural Tangents; the straight lines drawn from the Center are the Meridians, and as these, are all straight lines; so any great Circle drawn upon this Projection, will be a straight line, and any straight line drawn upon this Projection, will be a part of a great Circle, and shew the Longitude and Latitudes thereof.



As the Radius	10000
To the side AS Co-tangent, latitude 32, deg. 25	15745
So the Secant of the angle of longitude 10 deg.	10154
To the Co-tangent of the latitude of the Arch.	15987

1523  
7564  
159864

Thus you may work it by the ordinary Tables of Sines, Tangents, and Secants. But if you will work more easily by these Tables, then you need only turn to the angle of the longitude, as suppose 10 deg. and there according to your Radius 15745 take out the Secant thereof at two entries, first the two first figures, or 15000, the Table will shew for the Secant thereof 15.23. Then for 745, or  $74\frac{1}{2}$ . 75.64; which set in their order, and added together, makes 15986.4 the last figure 4 being to be cut off to make it agreeable to the Radius. And this number you shall find in the Table of natural tangents to answer to 57 deg. 97 parts, the Co-tangent whereof is the latitude of the Arch 32 deg. 03 parts. And thus you may do for any other degree of longitude, and set them down as in this Table.

The Angles of Longitude.	The Secants to the Radius	The tang. of those Se- cant numb.	The Co-tang. shewing the lat. of the Arch.
D. M.	15745		
00 0	15745	57 d. 58 p.	32 d. 42 pts.
10 0	15986	57 97	32 03
20 0	16758	59 17	30 83
30 0	18186	61 19	28 81
40 0	20379	63 86	26 14
50 0	24496	67 79	22 21
60 0	31500	72 39	17 16
70 0	46053	77 75	12 25
80 0	40699	83 70	06 30
90 0	Infinite	Infinite	00 00

In like manner the line DW shews the arch of the great Circle from the Straights of *Magellan*, being in 53 deg. South latitude, and the Island of *St. Thomas*, being under the Equinoctial, and having 90 deg. difference in *Longitude*. Which are thus to be cast up. The line AW shewing the *Latitude*.

Latitude of the said Straights is to the Radius, and so the Secants from A to the line WD, shew the complements of the latitudes of the arch, according to their angles of longitude as before.

It is somewhat more trouble, ( but not much ) when the angle of difference of longitude is more or less than 90 degrees; but here you must find out where the Perpendicular which must be your Radius, will fall upon the arch.

A second example when the two places differ more or less than 90 deg. in Longitude.

But yet this is easily performed in this case; for the complement of the difference of longitude, is the angle of the place from the Perpendicular, so that you may readily frame your Table, and set down your angles both from your Place and from the Perpendicular.

Thus suppose you were to sail from S to a place just under the Equinoctial, having 42 deg. difference of longitude; draw the line SF at the angle of 42 deg. from the point S, extending it on the other side of S to I or H, and let fall the Perpendicular upon this line in the point P, which as I said before, is the complement of the difference of longitude, so that SP is 48 degrees.

These angles being known, the length of the Perpendicular AP will be found by the length of the Hypothensal AS.

For as the Radius	10000
To the side AS	15745
So the sine of the angle at S 42 d.	6691
To the side AP the Perpend.	10535

The same number these tables will give, for if you turn to the angle 42, you shall find in the Sines under 48, ( the column being transposed ) for 15.020, to 10.04; and for 74 4952, which rightly placed and added, make 10535.2, the last figure being cut off: this is the length of your Radius AP, which is the tangent of 46 deg. 49 parts, the complement whereof is 43 deg. 51 parts, which is the greatest latitude of this arch.

1304  
4952  
-----  
105352

Now the angles at the perpendicular, and this Radius found; the other numbers are the Secants of those angles belonging to this Radius 10535, which you may soon take

N

CUR

out of the tables of Secants, and set down as in the following table, and so find the latitude of the arch as before.

*Proposition 4.*

*How to find the longitudes and latitudes of the Arch, when the two places lye, the one Northward, the other Southward from the Equinoctial.*

I have shewed plainly in my *Geometrical Seaman*, that tho the arch upon this Projection doth not so visibly cross the Equinoctial Line, because the tangents there run out to an infinite length : yet you may find very well where it will cross the Equinoctial ; by drawing a line parallel to any part of the arch, through the centre at A. Thus the line A F parallel to the line S F, doth cross the Equinoctial at 42 deg. as you may see by the degrees in the Circle. And so likewise the line E X K being parallel to this line, shews the arch represented thereby, which comes from the same point of the Equinoctial, and is the continuance of the arch S F upon the other side of the Equinoctial. And thus you may continue the arch round about the Globe if need were, as these two parallel lines F S I H, and E X K G, being equally distant from the centre A, are the greatest part of this arch round about the Globe.

Having therefore any two points of the Arch, you may find all the parts thereof. And these two points you always have ; for in this Situation, though you cannot draw this one line by both the latitudes, yet the opposite point of the one latitude, and the latitude of the other, serves as well as if the places were both upon one side the Equinoctial.

Thus if you were to sail from S, having North-latitude 32 deg. 42 parts, to X, having South-latitude 35 deg. 20 parts, and distant 90 deg. of longitude, you may draw one part of this Arch S F, by the latitude of S, and the opposite latitude of X in the point I ; and the other part of the Arch E X K by the latitude of X, and the opposite latitude of S, which is K.

And

And thus working in either part of this Arch to find the Perpendicular, and so where these Arches cross the Equinoctial according to the Rules of the second and third Proposition, you may work most exactly.

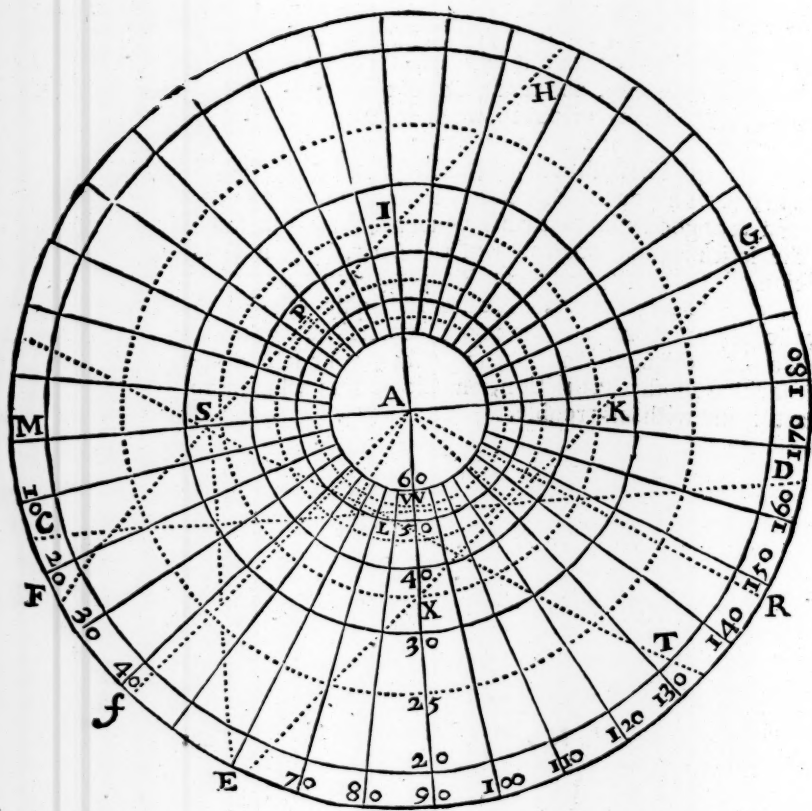
But, as I said before, if you be any thing careful, and work by a good large Tangent-line, you may find this Perpendicular, and the degree where it falls, exactly enough by your Ruler and Compasses, and save much of this labour, it being needless to be so curious to work to minutes, or hundred parts of a degree.

And though I have shewn you these ways of calculation, I would not wish you to keep strictly to them, only they may be of a very good use, that when you have found out some of the latitudes and longitudes of the Arch, by your Projection of Tangents, and your Tangents run out too far, (as they will in such places as are near the Equinoctial) then by the perpendicular, and the angles from it, you may make such a brief calculation as this, and so help your self without making another Projection, and do it somewhat more exactly, and with less trouble.

N 2

Thus





Thus

Thus in this example having drawn the line ISF and found the perpendicular to fall in P, at 48 degrees of longitude from S, and the length of it to be 10535, or the tangent of 46 deg. 49 parts; make a table of the angles, and work this Radius 10535, and you shall find the latitudes of the arch as in this table, though you had but two or three of them upon the Projection.

The angles of longit. from the point S.	The angles from the Per- pendicular P.	Secants to the Rad. 1035	The tang. of these Secants.	The Comp. or Latitude of the Arch.	
0 0	48 0	15745	57 58	32 42	North Lat.
10 0	58 0	19880	63 30	26 70	
20 0	68 0	28123	70 43	19 57	
30 0	78 0	50667	78 84	11 16	
40 0	88 0	301828	88 10	8 90	
The	Equi- noctial.				
50 0	98 0	75697	82 47	07 53	South Lat.
60 0	108 0	34092	73 80	16 35	
70 0	118 0	22440	65 65	24 82	
80 0	128 0	17112	59 98	30 30	
90 0	138 0	14176	54 70	35 20	

The first part of this table shews the way of the arch, from S to the Equinoctial, the latter part shews the way from the Equinoctial to X in 35 deg. 20 parts of South latitude, wherein all things are so plain, that I hope they need no further explaining, only here you may take notice, that the angles at the perpendicular being above 90 deg. in the latter part of the table, you must take their complements to 180, which is a sure Rule in any like case.

And thus these latitudes and longitudes of the arch being found out, your best way will be to prick them down upon your Sea-Chart, and so draw a bending line thereby from point to point, by which means you shall see all your voyage how to direct your Course sometimes upon one point, and sometimes upon another point of the Compass, that so you may always keep as near the arch of the great Circle as you

The angles being above 90 deg. take their complements to 180 degrees.

can, by which means you will not only sail the neareſt way, but many times the moſt convenient way, eſpecially when you are to run your courſe in or near a parallel of Eaſt and Weſt. As you may ſee this fully explained in the latter end of the fifth Chapter of my *Geometrical Seaman*.

### C H A P. IX.

*Shewing ſeveral Propositions very uſeful both in the Art of Navigation and Surveying.*

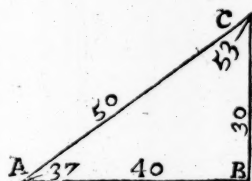
**T**HE Art of Navigation, and the Art of Surveying are more like one another than many think of, for that which the one doth upon the Land, the other doth upon the Water, which is to find the true diſtances and angles from place to place, only the Surveyour worketh upon ſhorter diſtances, and which require ſometimes more exactneſs; and the Seaman in larger, wherein he neither can nor need be ſo exact. And alſo he that will be a good Seaman, muſt have ſome ſkill in this Art of Surveying, that ſo he may be able to deſcribe the Coaſt of any Countrey or Iſland, Port or Harbour, which he ſhall happen to diſcover. And therefore as I ſhall not much wander from my intending purpoſe of Sailing, applying moſt of theſe Propositions that way; ſo in ſome things I ſhall direct the Surveyour ſo to order his work according to theſe Rules and Tables; that he ſhall perform his work hereby, better than by any other Inſtrument whatſoever.

And my intent here is not to ſhew you the uſe of the ſeveral Inſtruments whereby theſe things may be performed, but to help you in the calculation thereof by theſe Tables, having found the angles and ſome of the lines by any Inſtruments ſit for the purpoſe.

*Propoſition*

Proposition I.

Having the sloping side of a Hill, and the angle at the Foot thereof, to find the perpendicular height, and the length of the Horizontal line thereof.



Let the sloape side AC be 50 Poles, and the angle at A 37 degrees.

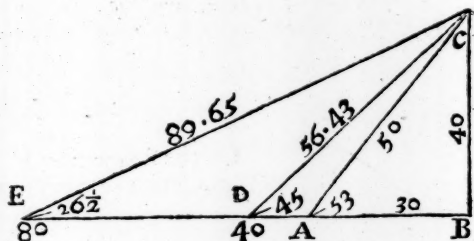
As the Radius or Sine of 90 degrees  
To the sloape side AC 50 Poles;  
So the sine of the angles at A or C,  
To the side opposed thereto.

Look in these tables for the angle at A, which is 37 deg. and find the length of the sloape side, which is 50 Poles in the Margent, and in that line in the two Columns of Sines, you shall have 39 Poles 93 parts for the one side, and 30 Poles 9 parts for the other side, which is 40 Poles *ferè*, for the Horizontal Line, and 30 Poles or little more for the Perpendicular Line.

Proposition II.

To find the height of an House, Steeple, Tower, or Tree from the ground, and the length of the Ladder which will scale it.

If you can approach the bottom or foot of a thing whose height you desire, the thing is easily performed by the Quadrant,



drat, or Crofs-Staffe, going so far back till you make the top of the thing to appear just at the angle of 45 deg. and then measure the distance from your standing to the thing, and it is equal to the height thereof, or more exactly, to so much thereof as is above the level of your eye. And then the sloap side is found by adding together the two squares of the sides, and subtracting the Square-Root thereof. Thus the angle at D being 45, and the distance from D to B being 40 feet or yards, the height BC is also 40 feet or yards. If you cannot come so near as to measure between your station of 45 deg. and the base of the thing, by reason of some Moat or Wall, yet by the proportion of the line of Quadrature you may help your self: in which case it is best to take such a distance backward for your second station, as may be equal to the height desired, wherein the Quadrant, or the degrees of the Quadrant will direct you.

Thus if you could not measure the distance from D to B, then go backward from D to E till you see the height C to make an angle of 26 degrees and a half, and measure the distance between D and E, it will be likewise 40 feet or yards equal to the height BC, the whole line EB being 80, which is double to the height.

If you cannot help your self any of these ways, but are forced to a certain station, then observe the angle at your said station, as at A, which is 53. degrees, and mea-

measure from thence to the foot of the thing, according to the line A B. 30 feet.

Then as the Radius or Tangent of 45 deg. 10000,  
 To the side A B 30 feet ;  
 So the tangent of 53 deg. 13270,  
 To the height B C 39 feet 81 parts ;  
 And so is the Secant of 53 degrees, 16616,  
 To the sloap line A C 49 feet, 85 parts.

Look in the tables for the angle 53 deg. and against 30 in the Margent, the tangent of 53 deg. is 39. 81, and the Secant is 49. 85, which is very near 40 feet, and 50 feet.

In like manner turn to the angle 45, and there against 40 in the margent, you shall have the tangent, or the line B C 40; and the Secant or line D C, 56.43 parts. So turn to the angle at E 26 deg.  $\frac{1}{2}$ , find the distance E B, which is 80 in the Margent, the tangent or line B C is 40, and the Secant, or line E C is 89. 65 parts.

*Proposition III.*

*To find the same things another way.*

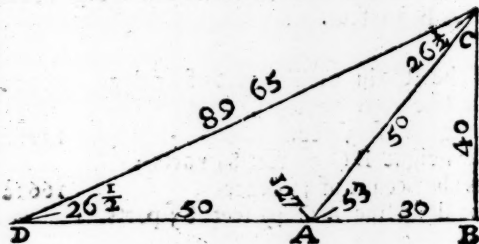
Though the Quadrant is good to find the Perpendicular, as I shewed before, yet it doth not so readily shew the Hypotenusal or Scaling Ladder, which in many cases is the chief thing looked after. This may be better found by the angles of the Quadrant, if you take notice of this Observation, which I think few hitherto have thought of.

Let your first station be any where at random, or as near as you can come to the foot of the Tower or Wall for the Ditch or Mote, as suppose at A, and observe there the angle of the height of the thing, which let be any degree whatsoever, as here it is 53 deg. I say, if you go so far backward from this Station at A toward D till you make the thing appear just at half the foresaid angle, which is here

26 deg.

Q





26 deg.  $\frac{1}{2}$ , that being the half of 53 deg. that then this distance from A to D is the true length of the sloap side AC without any farther trouble, and a Ladder of that length shall scale the said Moat and Wall, allowing only for the height of your eye above the Ground.

That this must needs be so, I prove it thus. In the Triangle ABC the angle at A is observed to be 53 deg. therefore the obtuse angle at A, of the Triangle DAC being the complement thereof to 180 deg. must needs be 127 deg. And the angle observed at D being 26 deg.  $\frac{1}{2}$ , being added to 127 deg. these two angles make 153 deg.  $\frac{1}{2}$ , therefore the third angle at A must \* needs be likewise 26 deg.  $\frac{1}{2}$ , being likewise the complement of the said two angles 153  $\frac{1}{2}$  deg. to 180. Now these two angles at D and C being both equal, viz. 26 deg.  $\frac{1}{2}$ , therefore the sides AD and AC must also be equal. So that the side AD being measured and found to be 50 Feet; the scaling Ladder AC must likewise be 50 Feet.

\* These are two Fundamental Axioms, that the three Angles of

a Triangle are equal to 180 deg. and that the sides are always in proportion to the opposite Angles. upon which this Proportion is grounded and proved: which though it hath not been observed, yet is very brief and useful both in this and some other following cases.

And now if by this line AC thus found out to be 50 Feet, you would also know the height of the Wall BC, and the breadth of the Ditch AB, turn to the angle observed at A which was 53 deg. and there against 50 in the Margent under the two Columns of Sines, you shall have 39 Feet

93 parts,

93 parts, for the height, and 30 Feet 9 parts for the width of the Ditch.

Proposition 4.

*Being upon the top of a Tower, Steeple, or Mast of a Ship, and observing the angle of the distance of any thing from you, to find the true distance thereof.*

These things may be found out by the Quadrant or Quadrant, for observing the proportional part of the Quadrant, you shall find the things to be 1, 2, 3, 5, or more times distant then the height of the Tower or Mast. So that if you know the height of them, you may soon find the distance.

But this may somewhat more easily be found by the angles of the Quadrant, especially if the numbers observed do not fall in equal parts, but that you must use proportion.

For in this case here is nothing to do in the using of these Tables, but turn to the angle of the distance, or the complement of the angle of depression, and find the height of the Tower or Mast in the Margent, and that line, the Tangent of distance, or Cotangent of depression, shews you the distance without any more trouble most exactly.

Thus let the height of the Tower or Mast be 40 Feet, and let the angle of Distance be 89 degrees, or one degree under the line of level: the Tangent belonging hereto against 40 in the Margent, is 2292.00, which shews the distance of the thing is just 2292 Feet. And so you may do for any other angle of distance as in this little Table.

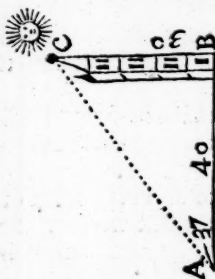
The angle of distance. Deg.	The true distance feet pts.	The angle of distance Deg.	The true distance. feet pts.
89	2292.00	75	149.28
88	1146.00	70	109.96
86	0764.00	65	085.78
87	0573.00	60	069.28
85	0477.20	55	057.13
84	0380.60	50	047.67
83	0226.85	45	040.00

The like Tables will shew you for any other height of the Tower or Mast in Feet or Yards, in any other measure, or for any other angle of distance whatsoever.

Proposition 5.

*By the height of the Sun, and the length of the Shadow, to find the height of any Tree, House, Tower, or Steeple.*

This is somewhat like to some of the former Propositions, only this way it may be more practical, for it is an hard



task to find the angle of the height of any House, Tree, &c. unless you have an Instrument fitted on purpose to a Standard, which may keep it at what angle you please: But this conclusion you may try (almost as well) by any little Quadrant or pocket Instrument. For by any of these you may observe the height of the Sun to a de-

gree, and its half or quarters, which will be sufficient for these conclusions.

And thus or any other way knowing the Sun's height, and measuring the length of the Shadow, the Rule is thus;

As the Radius 10000

To the length of the Shadow,

So the tangent of the Sun's height,

To the height of the thing desired;

Thus let the height of the Sun be 37 deg. and the length of the Shadow be 40 Feet.

Turn to the angle of 37 degrees, and against 40 in the Margent, you shall have for the Tangent 30.14, which shews the height to be a little above 30 Feet.

Proposition 6.

*Knowing the height of a Tower, House, or Tree, or any perpendicular Stile or Gnomon, to find the length of the Shadow thereof upon the Ground to any angle of the Sun's height desired.*

Let the Perpendicular B C be 30 Feet, and the angle of the Sun's height 37 degrees.

As the Radius 10000

To the height of the perpendicular C B 30 Feet;

So the cotangent of the Sun's height.

To the length of the Shadow.

Turn to the angle of the Sun's height in the Tables, which is 37 degrees, and there against 30 in the Margent, the cotangent of 37 degrees, (which is the tangent in the other Column) shews the length of the Shadow is 39 Feet 81 parts, or 40 Feet *ferè*.

Proposition 7.

*Knowing the height of the Perpendicular, and length of the Shadow, to know the angle of the Sun's height.*

As the height of the perpendicular.

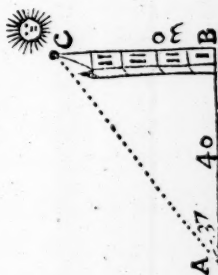
To the length of the shadow;

So is the Radius 10000

To the Cotangent of the height.

Let the perpendicular be 30 Feet high, and the shadow 40 Feet long, the Cotangent of the height is 37 degrees.

For turn over the Tables till you find some tangent or other, that shall be near 40.00 parts against 30 in



the

the Margent, this you shall find at the angle of 53, where againſt 30 in the Margent, the tangent is 39.81. So that you may judge the Sun's height to be according to the Cotangent thereof 37 degrees.

Proposition 8.

*To know when the Shadow of any perpendicular Stile or Gnomon is 1, 2, 3, 4, 5, or 10 times the length thereof.*

Look over the Table of Tangents, and ſee at what degrees the Radius which is 10000 doth encrease to ſuch a proportion as to make 20000, 30000, &c. which is twice, three times, &c. the Radius, and the Cotangents of thoſe numbers ſhew the height of the Sun, when the ſhadow will be ſo many times longer than the ſaid perpendicular, whether it be Tree, Houſe, Steeple, or any ſuch like.

Thus at 45 deg. the ſhadow is equal to the height.

At 26 deg. 56 parts, the ſhadow is double to the height.

At 18 deg. 43 parts, the ſhadow is three times the height.

At 14 deg. 04 parts, the ſhadow is four times the height.

At 11 deg. 31 parts, the ſhadow is five times the height.

At any of theſe times you may eaſily find the height of any thing by the ſhadow thereof.

Or you may perform this by any walking Staff, or ſuch like, for if you find the ſhadow thereof, (being held upright) to be 1, 2, 3, 4, 5, times the length thereof, you may judge the like by the ſhadow of any Tree, Houſe, or Steeple, and ſo by meaſuring the ſhadow thereof, at that inſtant find the true height thereof.

Proposition 9.

*Having the length of any Stile or Gnomon, ſtanding out at right Angles with any Perpendicular, to find the length of the contrary ſhadow, or the ſhadow upon the ſaid Perpendicular, at any degree of the Sun's height.*

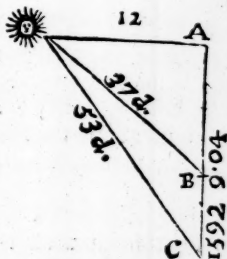
If you divide your Stile or Gnomon into 10 or 100 parts,  
ſo

so that it may have a visible proportion to the Radius of Tangents, which is 100, in the first part of the Columns of the Tables; or 10000 If you take in all the Figures, then the Tangents of the degrees in the Table, either in the tenth or last line thereof, will shew you the true length of the Shadow, according to the proportion of the Radius of your Gnomon, to the Radius of the Table.

But if your Gnomon be divided into any other number of parts, the rule is this;

As the Radius or Tangent of 45  
To the length or parts of the Gnomon  
So is the Tangent of the angle of the Sun's height  
To the length of the parts of the shadow.

Thus if you take a Carpenters square, whose shorter side is 12 Inches, and would know the length of the Shadow thereof, upon the longer side, being held up perpendicularly, the Sun's height being 37 degrees.



Turn to the angle of 37. deg. and against 12 in the Margent, you shall find the Tangent thereof is 09.04, that is 9 Inches 4 hundred parts: And here likewise you may see that shadow at 53 deg. which is the Cotangent will be 15.92, that is 16 Inches *feve*.

Proposition 10

*Observing how many Inches the Shadow of the short side of such a Square doth reach upon the longer, to find the height of the Sun thereby.*

The Radins here being the shorter side of the Square, which is 12 Inches, and the length of the shadow being 9 Inches, or 16 Inches. And the Sun's height is desired at these times.

Turn over the Tables, still having an eye to the number  
of



of your Radius (which is 12 Inches) in the Margent, untill you come to have a tangent number against it, which shall be the very same, or the nearest you can find to your number desired, and that is the angle of the Sun's height, which in this Example falls out to be much about 37 degrees, and 53 degrees.

By these two Conclusions, you may make the hook of any walking Staff to shew you the height of the Sun, making a Tangent line upon your staff. And hereby after the manner of a Cylinder, you may draw a Dial upon your Staff, to shew you the hour of the day by the height of the Sun at any time of the year. And though this will not be so useful for Sea-men, who sail into divers Countries, and continually are altering their Latitude; yet it is very ready for Land-men, to know the time of the day as they walk abroad.

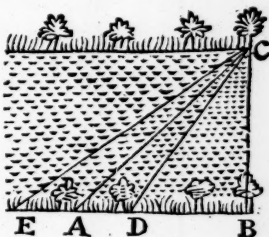
But yet if the cross Staff, or an Instrument somewhat like it were so fitted, that it might have a good heavy perpendicular Staff of about a Yard long, or a good weight at the end, to keep it steady; and a light transom at the top for a Gnomon, about 10 Inches or a Foot long, divided into 100 parts; you may by the Table of Tangents divide the Perpendicular exactly into degrees, which shall shew you the height of the Sun as exactly and conveniently as any other Instrument used for that purpose, if not better then most of them.

#### Proposition II.

*To find the distance of a Fort or Castle, that you dare not go to C, or the breadth of a River or Water; that you cannot pass or measure over it.*

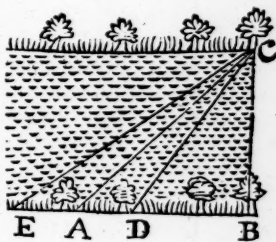
Standing upon the Bank of the River at B, observe some mark against you on the further side thereof, as C, and so setting up a Mark in the place where you stand at B, go either to the Right hand, or Left directly square-wise to these two marks, so far until you espie the mark C on the further

ther side doth justly make an angle of 45 degrees, with the mark B where you stood last, and this will be when you come to A. And now in this case having been careful to do this exactly, you need do nothing but measure the distance between your two stations B & A, and that shall be equal to the breadth of the River: So that if the one be 10, 20, 30, 40, or 100 poles, the other is also just as much. The like you may do though the angle be any other degree, either more or less than 45, but this is the best and readiest angle to find out such a distance: and therefore when you can use this, I would wish you to use no other.



The like also you may do at Sea, and thereby gain the distance of any Island, Cape, or Head-land from you, which you espie by chance, as you are sailing upon your Course, without any altering of your Course at all.

As if your course were East & West between A & B, & being at B, you spie Land at C, lying just at right angles with your course, keep a good account of your way till you come to A, where you observe the said Place C to make just an angle of 45 with your passed course BA, and so the distance of your way sailed between these two places, shall be the true distance of the place C from the first place of observation B.



The work is all one, though in saying it is most likely that the first place of your Observation will be at A, where you observe the place C to lye 45 degrees from your course AB, and afterward coming to B, you find there it lies just at Right angles from you, for so your distance sailed from A to B, is equal to the distance from B to C.

And if you would have the sloping distance A C, turn to the angle of 45 deg. and there finding your distance failed in the Margent, the Secant thereof will shew you the said sloap line. Thus if the distance failed A B be 10 Centesmes or Miles, the distance from A to C is 14.14, that is 14 Centesmes or Miles, and 14 hundred parts more.

Proposition 12.

*To find a distance by observing the angles upon which the thing lyes from you at any two places, one whereof shall be a right angle.*

It may sometimes so fall out, that either for want of room upon the Land, or want of Day-light upon the water, you cannot observe the place at the right angle, and the angle of 45 degrees, as aforesaid. In this it will be your best way to let the one of your Observations be at the right angle, and the other as your conveniency will serve either above or under 45 degrees, only it is good to let the distance you take be as much as you can, ( I mean so ) that the angle need not fall too much nearer than 45 degrees, the which in this case you need not exceed, unless sometimes you have let slip the time of your observation at 45 degrees before you are aware, and so you may make use of any angle rather than loose your pains in the former Observation.

In this case the work will not be much more than the former is, being only the Resolution of a right angled triangle, which you shall perform by this Rule.

As the Radius or Tangent of 45 degrees,  
To the distance failed;  
So is the Tangent of the acute angle observed,  
To the distance from the right angle observed.  
And so is the Secant of the acute angle,  
To the distance from the acute angle.

Thus the angle at D being 56 deg. or five Rhumbs from the Course, and the distance failed from B to D, being 10 Miles, or 10 Centesmes, which is two Leagues, and the distance

stance CB and CD is required. Look in the Tables for the angle of 56 deg. and against 10 in the Margent you shall find the Tangent thereof is 14.83, that is almost 15 Miles, or 15 Centesms, which is 3 Leagues, and this is the distance BC; And the Secant of this angle is 17.88, that is almost 18 Miles or Centesms; which is the distance DC.

The like manner of work it will be, if the place of the acute angle were beyond the angle of 45 degrees as at E, or at what angle soever it happens: but as I said, you need not go beyond the place of the angle of 45, for thereabouts is as good a distance as you can choose.

And either of these two ways you may observe likewise an Altitude which you cannot or dare not come near; for if you observe a time when the shadow is 2, 3, or 4 times the height of a thing, and observe at that instant where extremity of the shadow doth lie, make that place the Station of your right angle, and go from that place square-wise either to the right hand or left, till you come to an angle of 45 deg. or any other angle thereabouts, so you shall find as before the true length of the shadow, and by that the true height, better then by going backward from the place according to the ordinary way, as was shewed before in the 2 Proposition.

A good way to measure inaccessible heights.

Proposition 13.

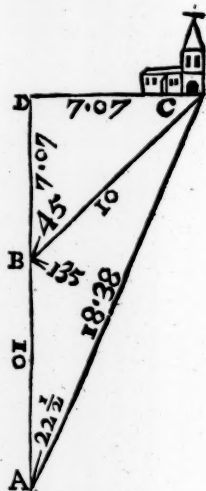
*By the way of your Ship, and any two angles of Position to find the distance of any Island, Cape, or Head-land from you.*

If you cannot with any conveniency bring the place espied by you to a right angle, yet you may do the business with a little more trouble by any two angles whatsoever, wherein first I shall shew you the ordinary way and how you may help your self herein.

The ordinary way is to take any two angles at random, provided the distance sailed between the two observations be any thing considerable to the distance of the place desired.

As thus, suppose you were sailing from A toward B full North, and being at A should espy a Land-mark C, bearing from you *NNE*, or *NE* 22 deg.  $\frac{1}{2}$ . And sailing still on your course to B about 10 Miles, should observe the said place C to bear full *NE* or 45 deg. and by these two observations, you would know the distance of the place C, from B, or A, or both, and also from the place at the right angle at D.

Here you have the oblique Triangle A B C to resolve in which you have the angle at A 22 deg.  $\frac{1}{2}$ . Then the Obtuse angle at B 135, being the complement of the acute at B, which was 45 to 180. And thirdly, you have the angle at C, which is the complement of both the aforesaid angles at A and B to 180, being 22 deg.  $\frac{1}{2}$ . And lastly you have the side of distance sailed A B, which is 10 Miles.



180

45

135

135

22 1/2

157 1/2

Therefore as the Sine of the angle at C 22 deg.  $\frac{1}{2}$ ,  
To the side opposed thereto, A B 10 Miles;  
So is the Sine of either of the other angles,  
To their opposite sides.

To perform this by these Tables, turn to the Sine of 22 deg.  $\frac{1}{2}$  and look down the Column of the Cosine 67 degrees  $\frac{1}{2}$ , (because these Columns are transposed) until you find your number of Miles, which is 10, which will be against 26 in the Margent (if you allow the proportional part) mark this Line in which you find it: Now turn to the other angle at B, which is 135 degrees, whose complement is 45 degrees, and there in the 26 Line of that Leaf, you shall find 18.38, which shews you the length of the line A C being 18 Miles  $\frac{18}{100}$  parts.

The like you might do for the other side B C, which here will fall out to be the same with A B; And having either of these slop sides, A C, or B C, you may either by the first case



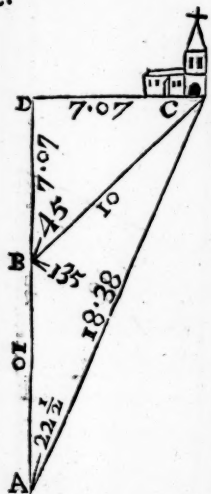


have the distance of the place C, from all these three places E D and B, and thus knowing the Radius C B, you may know the distance from it at any other angle.

### Proposition 15.

*To perform the same thing by two Angles chosen somewhat more readily.*

This Proposition is the best and most ready way to perform this, is by taking two such angles, that the angle at the second Station shall be either just the double, if you go nearer, or else just the half, if you go farther off then the angle at the first place. By this means the Calculation will be most easily performed, and there will be little trouble in the observation, for the one of the angles you may take at random, no matter what it is, only you must have a care to observe when you are just upon the half or double of the first angle; which you must also do if you were to work by a right angle: so that the trouble will be little more in this then in that.



For Example, suppose you were sailing full North from A toward B, and being at A should espy Land at C, bearing from you two Points to the Eastward viz. NNE, or NE 22 deg.  $\frac{1}{2}$ , and sailing still upon your course till you come to B, you there observe that the same place bears from you just 4 Points, or full NE 45 deg. which is just double to the angle you observed at A. If you should do no more then thus, yet by this you may assure your self that the distance you have sailed between A and B is justly equal to the distance between

the second place B, and C the place observed: So that if A B be 10 Miles, or Centesms, B C is likewise 10 Miles or Centesms.

That

That this must needs be thus is plain; for in the Triangle A B C the acute angle or outward angle at B being 45 deg. the obtuse and inward angle being the complement thereof to 180, must be 135 deg. and the angle at A 22 deg.  $\frac{1}{2}$ ; being added to this, makes 157 deg.  $\frac{1}{2}$ , which subtracted from 180, there must needs rest for the angle at C 22 deg.  $\frac{1}{2}$ . Now this angle at C, being equal to the angle at A, which was 22 deg.  $\frac{1}{2}$  also, therefore the side A B opposed to the one, must needs be equal to the side B C, opposed to the other. So that the distance sailed from A to B, is equal to the distance from B to C, and upon this account may be known without any farther trouble or Calculation.

And this falls out not only thus in this angle, but in any other, as you may see in the 3 Proposition; and you may easily try it in any other angle. So that let your first angle be what it will, you need not much care, only watch when you bring the place to the double, or half at the second place of observation, as you go nearer, or farther from the place.

Thus in approaching to  
a place.

The first  
angle ob-  
served  
being

$\frac{1}{2}$  a point.  
1 point.  
2 points.  
4 points.

The se-  
cond ob-  
servation  
must be

1 point.  
2 points.  
4 points.  
8 points.

Or in going from a place

The first  
angle ob-  
served  
being

8 points.  
4 points.  
2 points.  
1 point.

The se-  
cond an-  
gle must  
be

4 points.  
2 points.  
1 point.  
 $\frac{1}{2}$  point.

The same is true also in the degrees of the Quadrant, and holds good though you pass the right angle.

The

The first.	The second.	The first.	The second.
1 degree.	2 degrees.	160 degrees.	80 degrees.
2 degrees.	4 degrees.	80 degrees.	40 degrees.
4 degrees.	8 degrees.	40 degrees.	20 degrees.
8 degrees.	16 degrees.	20 degrees.	10 degrees.
16 degrees.	32 degrees.	10 degrees.	5 degrees.
32 degrees.	64 degrees.	5 degrees.	2 deg. $\frac{1}{2}$
64 degrees.	128 degrees.	2 deg. $\frac{1}{2}$	1 deg. $\frac{1}{4}$

And now if you would know how far A the other place of your observation, is distant from C, you may do it several ways.

As first in the Triangle ABC: you have the side AB which is the distance you have sailed, which suppose to be 10 Miles or Centesims, and the side BC which is equal thereto, and all the three angles; therefore by the opposition of sides and angles you may find the side AC to be 18 Miles or Centesims, and 38 parts, as I shewed before in the 13 Proposition of this Chapter.

But it will be the better way if you find the Radical distance, or distance DC, at the right angle, so you shall afterward readily find the distance of the place at any other angle.

And this Radical distance is thus found out, for here you have slope Line or Hypothensal BC, and the angle at B 45, and therefore according to the first case of Triangles, turn to the angle 45, and there against the length of your slope side 10 Miles or Centesims, you shall find the 2 Columns of Sines giving you for the 2 sides 07.07 (which here fall out to be both equal) this 07.07 parts is your Radius CD, and now the Secant of the complement of any angle observed, will give the distance thereof.

Thus the angle at A being 22 deg.  $\frac{1}{4}$ , turn to this angle, and if you use the proportional part, for the parts of the degree, and the parts of the number, you shall find the Co-Secant for this distance and angle to be 18.38 parts, as before.

And thus you may find the true distance of any other place,

place, from this place C, by the angle observed at the said place, as long as you are in sight thereof, keeping your way still upon the same course.

Proposition 16.

*Knowing the distance between two places on the Land, and how they bear one from the other, and having their angles of Position at the Ship, to find the distance of your Ship from either of them.*

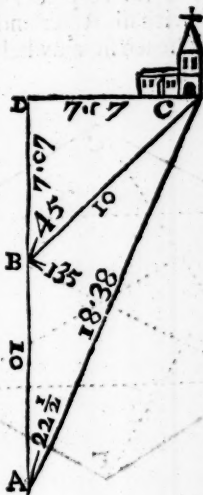
This Proposition is laid down, and thus resolved by Mr. Gunter, in the end of his cross Staff.

But the best way to observe, is to bring one of the places to a right angle, as if the place lie East and West, to bring one of them North or South of your Ship: so you shall have a right angled Triangle, whose three angles and one of the sides are known, which he shews how to resolve by Sines; but it is better to do it by the Tangents and Secants, making the distance between the two places your Radius.

Let the two places be D and C, which lie East and West, and the distance between them 7 Miles 7 parts, and let the Ship be at A, and the angle observed between D and C  $22^{\circ} \frac{1}{2}$ .

Turn to this angle of  $22^{\circ}$  deg. or  $23^{\circ}$  deg. and against 7.07 in the Margent, the Co-tangent or side DA is 17.07 parts, and the Co-secant or side AC is 18.38 parts.

In this case you may much help your self with the two former Propositions, for though it be hard to meet with two Land-marks in such a fit Position, yet by any single Land-mark you may find the Radical



Q

distance,

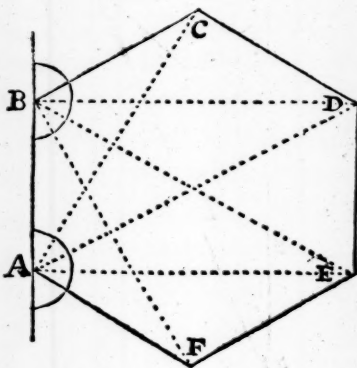
distance, between any place upon the Land, and your Ship's way, which being known; the Work is all one with this, and by the angle of Position at any time, you may know the distance of your Ship, and so what speed you make either to or from your part or Port espied.

Proposition 17.

*To take the Plat of a Port, City, Coast, or Country.*

All that I have said before, hath been chiefly to prepare and fit you for these following Propositions, wherein you may have occasion to use many or the most of them, and therefore have been so plain and large before, I shall be somewhat the briefer now, only mentioning them, or referring to them.

It may be sufficient for the Sea-man's use in taking the plat of a Port, City, Coast, or Country, only to observe the angles which the chief Buildings, Capes, Points or Rivers make from his Ship at two several places; and so by the distance of those two places of his observation, he may draw them out with his Ruler and Compasses upon a Sheet of Paper, or if he see fit may help himself: sometimes with the former rules.



Let the two places of observation be A and B, being just North and South, being distant 5 Miles or Leagues, or 50 Poles and the angles from the said two places, according to observation as followeth.

The

The angles taken at A.		The angles observed at B.	
AB North	00.00	BC N. East	60 deg.
AC N. East	30 deg.	BD East	00.00
AD N. East	60 deg.	BE S. East	60 deg.
AE East	00.0.	BF S. East	30 deg.
AF S. East.	60 deg.	BA South	00.00

I hope I need not tell you the manner how to observe these angles, you may do it either by a Theodolite, or a Circumferentor, or Peracton, or by your Compass, or by the Cross-staff observing every angle or eminent mark, as House, Church, Tree, &c. from the place next unto it, and by these angles thus observed, you may set down the Plot thereof in Paper to any largeness you please.

But the best and readiest way to do it, is by a Plain Table fitted for the purpose, or you may make shift with a Sheet of Paper, after the manner of the Plain Table. Wherein first taking a Center point at A, and laying a Ruler with sights thereto, turn it about to the several places BCDEF, and draw lines from A to either of those marks. Then being come to your second Station B, lay down your Paper again, and take a convenient Scale for your distance, set it off in the line AB, according to the distance of your two Stations, make B your Center point; and laying your Ruler thereto, turn it so that it may lie just upon the line BA, and keeping your Ruler there: turn it, and the Table or Paper altogether, till you see the place of your first Station A, by the sights upon your Ruler; and having so done, keep your Table fixed there, but turn your Ruler backward again to the several places FEDC, and draw the Lines thereby. Now the chief thing is to mark where these Lines last drawn from the Station at B, cross the Lines which were drawn before from the Station at A, which is in the said points CDEF, and these crossings will shew the Model or the Position, and distance of all these places each from other, so that you may measure the distance of any of them, if you divide the line AB between the two



center points, according to the Scale of distance, by which you set off your two Stations each from other: And this will be exact enough for the Sea-man's purpose.

And thus if you will not be too curious, if your Instruments are any thing large, and so well fitted for the purpose, so that you may be well assured of the exactness of the angles; then by the side known AB, and the angles observed at those two Stations, you may find out the length of any of the Lines, and so either with your Compasses, or by these Tables bring it into a lesser or a greater compass: or if it be a piece of Land to be measured, you may bring it into Triangles or Trapeziums, and find the length of the Lines, and so cast up the Contents thereof.

Proposition 18.

*A more exact method for the true Surveying of any parcel of Land whether great or small.*

Hitherto I have taught the Sea-man some things of the Art of Surveying; now I shall teach the Surveyor somewhat of the Sea-man's practice, and that is how he shall order his accounts by these Traverse Tables, reckoning by Latitude and Longitude as the Sea-man doth, whereby he shall perform his work more readily and exactly then by any other Instrument: observing these following directions.

1. *For the ordering of your work in the Field.*

When you have any parcel of Land to measure, you must measure the bounds thereof round about side by side, from angle to angle, observing exactly either by your Needle, Compass, or other Instrument fit for the purpose how the said sides lie at each angle: and this you must set down in some Book or Table fitted for the purpose, being divided into several Columns as you see this following. And herein it will be best to begin at some angle which lies most North-Westerly, or South-Westerly, that so the Latitude

tude and Longitude may fall in the better order in your Table, without too often altering your work from Addition to Substraction. And this is all you need do in the Field, only for your better direction and memory, you may with your Pen at random draw any little Plot thereof, as near the truth as you can, to which you may add such observations concerning the bounds thereof, as are necessary to be observed. This way of measuring the sides and angles, is the best for all manner of Grounds or parcels of Land, great or small, whether they be little and plain Fields, so that you may measure them on the inside, and see over them from side to side: or whether they be large and covered Forrests, Parks, or Woods, which you cannot see over or through.

2. *How to make a Table which shall shew you the difference of Latitude and Longitude, of all the angles from your first Station, and also from any of the other Stations.*

Having done your work in the Field, and being come into the house or place convenient, look over your notes and according to the angles of Position and lengths of the several sides, find out by these Tables the difference of their Northing and Southing, Easting and Westing of the several angular points one from the other. And this you must set down in your Book or Table provided for that purpose in this form following. And in the two last Columns you may so add or subtract the other four Columns together, (still reckoning the line following to the former sums) that they may shew the true difference of Longitude and Latitude of any of the said Points, from your first chosen point A, as if that were the first Meridian, under the Equinoctial: and this also with a little more trouble, will give you the difference of Longitude and Latitude, from any of the other Points also, as by the Tables of the Longitude and Latitude of places, you find their difference of Longitude and Latitude: by the which also according to the rules of \* Plain Sailing aforesaid, you may come to find the true Position and distance of any of the said angular Points or Stations each from other.

\* See the Chapter of Plain Sailing.

And

And though few parcels of Land thus to be measured extend so far as to be accounted in degrees of Longitude and Latitude, in respect of the Globe of the Earth, (as the Sea-man many times hath occasion to reckon) one degree thereon containing above 3600 Poles, yet this is also true Longitude and Latitude, and may fitly be so called, though in never so small quantity, and measured by any measures, as Chains, Poles, Yards, Feet or Inches.

The Stations.	Position	Dist.	North	South	East	West	Latit.	Longit.
	Deg.	pol. pts.	po. pts.	po. pts.	po. pts.	po. pts.	pol. pts.	pol. pts.
The first A							0	0
A to B	N E 20	80 0	5 18		27 36		75 N 18	27 E 36
B to C	N E 80	80 0	13 89		78 78		69 07	106 14
C to D	S E 40	80 0		61 28	51 42		27 70	157 56
D to E	W 20	80 0		75 18		27 36	47 S 39	130 20
E to F	S W 80	80 0		13 89		78 78	61 28	51 42
F to G	N W 40	80 0	61 28			51 42	0	0

150 35 | 150 35 | 157 56 | 157 56

3 *How to prove your work, whether you have taken the true measure of all the sides and angles of the Plat, or not.*

This is a thing very necessary to be known, before you proceed any farther, and this will readily be found out by the foresaid Table these two ways.

First, if you cast up the four middle Columns of the Table, intitled North, South, East, West, and find that the sum of the North column, is equal to the sum of the South; and that the sum of the East, is equal to the sum of the West; as it is here; the North and South being either of them 150 Poles, 35 parts; and the East and West being 157 56, then you may be sure that all your work hitherto is right, and so you may proceed. But if you find any, or at least any great difference, you must go over your work again: wherein you may first see, whether you are not mistaken in setting down the Northing, Southing, Easting or Westing, out of the Tables, and if you find not the fault there

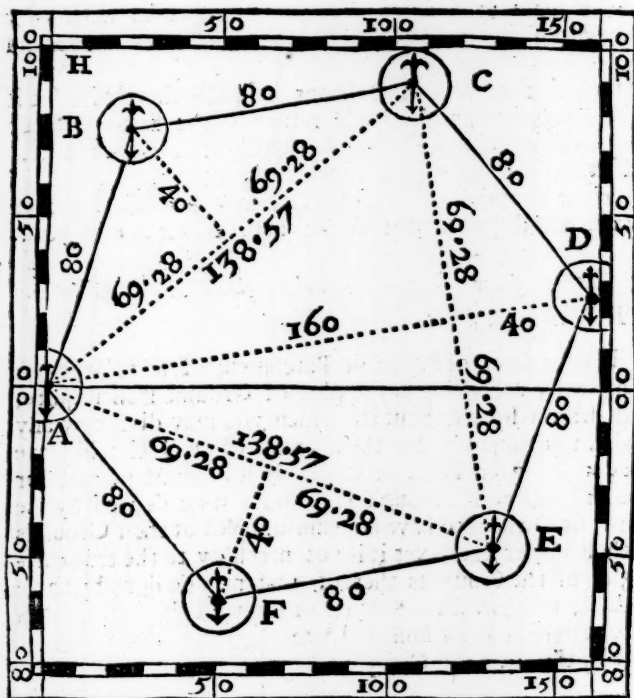
there, you must measure over the Field, and observe the angles again more carefully, comparing them with your former observations, so you shall find your error and amend it.

Or else the two last Columns will also shew this, for if your Longitude and Latitude return to the first Points or (o) as here it doth, all your work hitherto is right: otherwise there is some mistake. But this is rather a proof of the right summing of these two Columns then of the former work, and so you may use either, but it is best to take both.

4. *How to draw the true model or plat of the Land in any quantity you please.*

Take a sheet of Paper or Parchment of what largeness you please, according as the plot of Ground shall require, and draw a square about it, which you may divide by any Scale of equal parts, but the quantity of one Inch will serve very well for ten Poles or Chains in a large Map, and for 100 in a lesser, for though sometimes it be desired by the Lords or Owners to have an handsom plot of their Grounds in these larger sizes, yet it is not necessary to the true casting up of the Contents thereof, that may be done by these Tables, and any little Scheam or Draught thereof, as well by one which is an hundred times greater, the ordinary way by the Scale and Compass.

Having



Having therefore determined your Scale, according to your occasion, and divided and numbred by your Square accordingly; set down therein the several angular Points **A B C D E F**, according to their Longitude and Latitude from the first point **A**, according to the rules of the Plain Chart.

Thus having chosen a fit place where the point **A** should stand, let **B** be placed from it 75 Poles, 18 parts Northward, and 27 Poles, 36 parts Eastward: which you may do by laying a Ruler first to the Latitude thereof in the sides of the Table, and drawing a small occult Line, and then laying

laying your Ruler to the top and bottom of the Square, at the Longitude thereof, cross the foresaid line; and that is the point of the angle B. So you must do for the points C D E F, according to their Longitude and Latitude in the Table, and then draw the lines from A to B, from B to C, and so round about till you come to A again, and thus you have the true form of the bounds of the said Field, Wood, Park or Forrest, which you would measure. In the further particulars whereof the draught it self will direct you better then many words.

5. *How to cast up the content of any parcel of Land in Poles and Arches.*

My intent here is not to shew you how to measure any parcel of Land according to the form it lies in, whether it be Circular, Square, or Triangular, &c. but having the plot of the Field before you, cast it into some regular form (which commonly will fall into Triangles or Trapeziums) making as few parcels thereof as you can: And knowing all the sides which bound the Field, and the angles thereof, if you would know the true quantity of any other side or angle necessary for the casting up of the Contents, you may find it out either by the Doctrine of Plain Triangles, or by the rules of Plain Sailing, and thus casting up the Contents of the several parts, and adding them together, the total sum will be the true content of the parcel of Land.

For example, though this be a regular Hexagon, and the Contents might be found out a nearer way, yet for example sake, I shall divide it into four Triangles from the point A, by the lines A C, A D and A E, and most of the angles of these Triangles are known, if you observe the Position of the places from each other, and make Subtraction according to the angles before and after.

But when you cannot readily find the angles this way, you may make use of the rules of Plain Sailing, and by the difference of Longitude and Latitude of any two  
R places,



places, find out the angle of their Rhumb, and the distance between them. As now in the Triangle ABC, if you would find the angle at A, and the distance AC. First, find the difference of Longitude and Latitude of C from A, which the Table shews you, being North from A 89 Poles, 07 parts, and East 106 Poles 14 parts.

Now as the difference of Latitude	89.07
To the difference of Longitude	106 14
So is the Radius or Tangent of 45	10000
To the Tangent of the angle from the Merid.	119.17
Which is the Tangent of 50 degrees.	

Again as the Radius or	100.00
To the difference of Latitude	89.07
So is the Secant of this angle 50 degrees.	155.57
To the Secant or side AC	138.57

By these three sides now, BC 80 Poles, CD 80 Poles, and AC 138 Poles 57 parts, you may find the content of the Triangle by the Tables of Logarithms, but it is better to let fall the perpendicular from B upon this line AC, which thus you may do.

The whole angle HAC being found to be	50 degrees,
The angle HAB to be subtracted	20 degrees,
There remains for the angle BAC	30 degrees,
Now as the Radius	100.00
To the side AB 80 Poles	80
So the Sine, (or rather Cosine) of the angle	30 deg.
To the Perpendicular 80 Poles	40

And now the side AC 130 Poles 57, multiplied by half this perpendicular; yields 2771 poles 40 parts, which is the content of the said Triangle.

So likewise in the Triangle ACD, the side AC was found in the last Triangle to be 138.57, the side CD is 80 poles, and for the side AD and the angle at A, you may find it as before, by the Northing and Easting of D from A,

A, which is North 27.79, and East 157.56 parts : which gives the whole angle H A D 80 degrees, and the side A D 160 poles. Now if you take the angle H A C 50 degrees, from this 80 degrees, there remains for this angle 30 degrees, by which angle 30 degrees, and the side A C 138.37 parts, you will find the perpendicular from C to be 69.28 parts, and this multiplied by the half of the side A D which is 80 poles, yields for the content 5542 poles, 40 parts.

The like you may do for the other two Triangles A D E, and A E F, which are like to the two former, so that it is needless to go over the same again, and much of this labour might be spared also, if when you are in the Field you observe those angles round about from the place A; For that is the most troublesome part of the work; the sides being easily found by the Secants, and the perpendiculars by the Sines, which you may perform by these Tables, either by turning to the angles, where you shall find your Numbers ready cast up to your hand, or at most you may take it out at twice, and add them together.

In the last place for the content of the whole Field, you must add all these several Triangles together, and divide the product by 160 poles, so you shall bring it into Acres; Thus,

	poles	parts
The content of the triangle A B C is	2771	40
The content of the triangle A C D is	5542	40
The content of the triangle A D E is	5542	40
The content of the triangle A E F is	2771	40
<hr/>		
The sum of all is	16627	60

Which divided by 160 poles, the content of one Acre, yields 103 Acres, 147 Poles, 60 Parts, or 103 Acres, 3 Quarters, or 3 Roods, 27 Poles, 60 Parts.

Last of all as you do here by one large Field, parting it into several parcels, and so measure it; So you may do

do by a great Lordship or Manor, which hath several Fields and parcels of Land belonging to it. First, measure the bounds thereof round about, and lay down the plat thereof. Then measure the bounds of the several Fields, and set them down in your Plat, and thereby you shall by some few of the lines and angles, find the content of the several Fields; and adding them all together, know the content of the whole Manor, and describe a true Plat thereof.

But of these things I only give you a short view, they being somewhat beside my intended purpose, yet I hope this will be enough to instruct you how to take the true Plat of any Sea-Coast. Port or Island, as you sail along by it upon the Sea, or if need be to describe any Country you shall have occasion to land upon; which may be of great use, especially when you discover any such places as are not yet found out, or fully and truly described in your Maps and Charts.

FINIS.

THE  
Seamans Canon  
OF  
TRIANGLES.

Or New Tables of

Sines, Tangents and Secants,  
in Natural Numbers : to any  
Radius desired.

Briefly and plainly resolving all Cases of  
Right lined Triangles ( Instrumentally )  
by looking upon the Tables, without any Calculation.

By HENRY PHILIPPES.

*London, Printed by J. Gain, for W. Fisher at the Postern  
near Tower Hill, Tho. Passenger on London Bridge, and  
R. Smith under the Royal Exchange in Cornhill, 1684.*

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	I	89		I	89		I	89	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	01 00	00 02	1	01 00	057 30	1	01 00	057 30	1
2	02 00	00 04	2	02 00	114 60	2	02 00	114 60	2
3	03 00	00 05	3	03 00	171 90	3	03 00	171 90	3
4	04 00	00 07	4	04 00	229 20	4	04 00	229 20	4
5	05 00	00 09	5	05 00	286 50	5	05 00	286 50	5
6	06 00	00 10	6	06 00	343 80	6	06 00	343 80	6
7	07 00	00 12	7	07 00	401 10	7	07 00	401 10	7
8	08 00	00 14	8	08 00	458 40	8	08 00	458 40	8
9	09 00	00 16	9	09 00	515 70	9	09 00	515 70	9
10	10 00	00 18	10	10 00	573 00	10	10 00	573 00	10
11	11 00	00 19	11	11 00	630 30	11	11 00	630 30	11
12	12 00	00 21	12	12 00	687 60	12	12 00	687 60	12
13	13 00	00 23	13	13 00	744 90	13	13 00	744 90	13
14	14 00	00 24	14	14 00	802 20	14	14 00	802 20	14
15	15 00	00 26	15	15 00	859 50	15	15 00	859 50	15
16	16 00	00 28	16	16 00	916 80	16	16 00	916 80	16
17	17 00	00 30	17	17 00	974 10	17	17 00	974 10	17
18	18 00	00 31	18	18 00	1031 40	18	18 00	1031 40	18
19	19 00	00 33	19	19 00	1088 70	19	19 00	1088 70	19
20	20 00	00 35	20	20 00	1146 00	20	20 00	1146 00	20
21	21 00	00 37	21	21 00	1203 30	21	21 00	1203 30	21
22	22 00	00 38	22	22 00	1260 60	22	22 00	1260 60	22
23	23 00	00 40	23	23 00	1317 90	23	23 00	1317 90	23
24	24 00	00 42	24	24 00	1376 20	24	24 00	1376 20	24
25	25 00	00 44	25	25 00	1432 50	25	25 00	1432 50	25
26	26 00	00 45	26	26 00	1489 80	26	26 00	1489 80	26
27	27 00	00 47	27	27 00	1547 10	27	27 00	1547 10	27
28	28 00	00 49	28	28 00	1604 40	28	28 00	1604 40	28
29	29 00	00 51	29	29 00	1661 70	29	29 00	1661 70	29
30	30 00	00 52	30	30 00	1719 00	30	30 00	1719 00	30
31	31 00	00 54	31	31 00	1776 30	31	31 00	1776 30	31
32	32 00	00 56	32	32 00	1833 60	32	32 00	1833 60	32
33	33 00	00 58	33	33 00	1890 90	33	33 00	1890 90	33
34	34 00	00 59	34	34 00	1948 20	34	34 00	1948 20	34
35	35 00	00 61	35	35 00	2005 50	35	35 00	2005 50	35
36	36 00	00 63	36	36 00	2062 80	36	36 00	2062 80	36
37	37 00	00 65	37	37 00	2120 10	37	37 00	2120 10	37
38	38 00	00 66	38	38 00	2177 40	38	38 00	2177 40	38
39	39 00	00 68	39	39 00	2234 70	39	39 00	2234 70	39
40	40 00	00 70	40	40 00	2292 00	40	40 00	2292 00	40
41	41 00	00 72	41	41 00	2349 30	41	41 00	2349 30	41
42	42 00	00 73	42	42 00	2406 60	42	42 00	2406 60	42
43	43 00	00 75	43	43 00	2463 90	43	43 00	2463 90	43
44	44 00	00 77	44	44 00	2521 20	44	44 00	2521 20	44
45	45 00	00 78	45	45 00	2578 50	45	45 00	2578 50	45
46	46 00	00 80	46	46 00	2635 80	46	46 00	2635 80	46
47	47 00	00 82	47	47 00	2693 10	47	47 00	2693 10	47
48	48 00	00 84	48	48 00	2750 40	48	48 00	2750 40	48
49	49 00	00 86	49	49 00	2807 70	49	49 00	2807 70	49
50	50 00	00 87	50	50 00	2865 00	50	50 00	2865 00	50

o Rhumb and a half is 5 deg. 37 min. and a half.

Numbers	Sines			Tangents			Secants.		Numbers
	Degrees			Degrees			Degrees.		
	I	89		I	89		I	89	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	51 00	0 89		0 89	2922 30		51 01	2 21 30	51
52	52 00	0 91		0 91	2979 60		52 01	2 37 9	52
53	53 00	0 93		0 93	3036 90		53 01	3 03 6	53
54	54 00	0 94		0 94	3094 20		54 01	3 09 1	54
55	55 00	0 96		0 96	3151 50		55 01	3 15 1	55
56	56 00	0 98		0 98	3208 80		56 01	3 20 8	56
57	57 00	0 99		0 99	3266 10		57 01	3 26 6	57
58	58 00	1 01		1 01	3323 40		58 01	3 32 5	58
59	59 00	1 03		1 03	3380 70		59 01	3 38 0	59
60	60 00	1 05		1 05	3438 00		60 01	3 43 8	60
61	61 00	1 06		1 06	3495 30		61 01	3 49 5	61
62	62 00	1 08		1 08	3552 60		62 01	3 55 2	62
63	63 00	1 10		1 10	3609 90		63 01	3 60 9	63
64	64 00	1 12		1 12	3667 20		64 01	3 66 7	64
65	65 00	1 13		1 13	3724 50		65 01	3 72 4	65
66	66 00	1 15		1 15	3781 80		66 01	3 78 1	66
67	67 00	1 17		1 17	3839 10		67 01	3 83 9	67
68	68 00	1 19		1 19	3896 40		68 01	3 89 6	68
69	69 00	1 20		1 20	3953 70		69 01	3 95 3	69
70	70 00	1 22		1 22	4011 00		70 01	4 01 1	70
71	71 00	1 24		1 24	4068 30		71 01	4 06 8	71
72	72 00	1 26		1 26	4125 60		72 01	4 12 5	72
73	73 00	1 27		1 27	4182 90		73 01	4 18 2	73
74	74 00	1 29		1 29	4240 20		74 01	4 24 0	74
75	75 00	1 31		1 31	4297 50		75 01	4 29 7	75
76	76 00	1 33		1 33	4354 80		76 01	4 35 2	76
77	77 00	1 34		1 34	4412 10		77 01	4 41 2	77
78	78 00	1 36		1 36	4469 40		78 01	4 46 9	78
79	79 00	1 38		1 38	4526 70		79 01	4 52 6	79
80	80 00	1 40		1 40	4584 00		80 01	4 58 4	80
81	81 00	1 41		1 41	4641 30		81 01	4 64 1	81
82	82 00	1 43		1 43	4698 60		82 01	4 69 8	82
83	83 00	1 45		1 45	4755 90		83 01	4 75 5	83
84	84 00	1 47		1 47	4813 20		84 01	4 81 3	84
85	85 00	1 48		1 48	4870 50		85 01	4 87 0	85
86	86 00	1 50		1 50	4927 80		86 01	4 92 7	86
87	87 00	1 52		1 52	4985 10		87 01	4 98 5	87
88	88 00	1 54		1 54	5042 40		88 01	5 04 2	88
89	89 00	1 55		1 55	5099 70		89 01	5 09 9	89
90	90 00	1 57		1 57	5157 00		90 01	5 15 7	90
91	91 00	1 59		1 59	5214 30		91 01	5 21 4	91
92	92 00	1 60		1 60	5271 60		92 01	5 27 1	92
93	93 00	1 62		1 62	5328 90		93 01	5 32 8	93
94	94 00	1 64		1 64	5386 20		94 01	5 38 6	94
95	95 00	1 65		1 66	5443 50		95 01	5 44 3	95
96	96 00	1 67		1 67	5500 80		96 01	5 50 0	96
97	97 00	1 69		1 69	5558 10		97 01	5 55 8	97
98	98 00	1 71		1 71	5615 40		98 01	5 61 5	98
99	99 00	1 73		1 73	5672 70		99 02	5 67 2	99
100	100 00	1 75		1 75	6770 00		100 02	5730 00	100



Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	2	88		2	88		2	88	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	0 00	00 03	difference	0 03	28 55	difference	1 00	28 55	1
2	0 01	00 07	difference	0 07	57 30	difference	2 00	57 30	2
3	0 02	00 10	difference	0 10	85 95	difference	3 00	85 95	3
4	0 03	00 14	difference	0 14	114 60	difference	4 00	114 60	4
5	0 04	00 17	difference	0 17	145 25	difference	5 00	145 25	5
6	0 05	00 21	difference	0 21	171 00	difference	6 00	171 00	6
7	0 06	00 24	difference	0 24	200 55	difference	7 00	200 55	7
8	0 07	00 28	difference	0 28	229 20	difference	8 00	229 20	8
9	0 08	00 31	difference	0 31	257 85	difference	9 00	257 85	9
10	0 09	00 35	difference	0 35	286 50	difference	10 00	286 50	10
11	0 10	00 38	difference	0 38	315 15	difference	11 01	315 15	11
12	0 11	00 42	difference	0 42	343 00	difference	12 01	343 00	12
13	0 12	00 45	difference	0 45	372 45	difference	13 01	372 45	13
14	0 13	00 49	difference	0 49	401 10	difference	14 01	401 10	14
15	0 14	00 51	difference	0 52	429 75	difference	15 01	429 75	15
16	0 15	00 56	difference	0 56	458 40	difference	16 01	458 40	16
17	0 16	00 59	difference	0 59	487 05	difference	17 01	487 05	17
18	0 17	00 63	difference	0 63	515 70	difference	18 01	515 70	18
19	0 18	00 66	difference	0 66	544 35	difference	19 01	544 35	19
20	0 19	00 70	difference	0 70	573 00	difference	20 01	573 00	20
21	0 20	00 73	difference	0 73	601 95	difference	21 01	601 95	21
22	0 21	00 77	difference	0 77	630 30	difference	22 01	630 30	22
23	0 22	00 80	difference	0 80	658 05	difference	23 01	658 05	23
24	0 23	00 84	difference	0 84	687 00	difference	24 01	687 00	24
25	0 24	00 87	difference	0 87	716 25	difference	25 01	716 25	25
26	0 25	00 91	difference	0 91	744 60	difference	26 02	744 90	26
27	0 26	00 94	difference	0 94	773 55	difference	27 02	773 55	27
28	0 27	00 98	difference	0 98	802 20	difference	28 02	802 20	28
29	0 28	01 01	difference	1 01	830 85	difference	29 02	830 85	29
30	0 29	01 05	difference	1 05	859 50	difference	30 02	859 50	30
31	0 30	01 08	difference	1 08	888 15	difference	31 02	888 15	31
32	0 31	01 12	difference	1 12	916 00	difference	32 02	916 00	32
33	0 32	01 15	difference	1 15	945 45	difference	33 02	945 45	33
34	0 33	01 19	difference	1 19	974 10	difference	34 02	974 10	34
35	0 34	01 22	difference	1 22	1002 75	difference	35 02	1002 75	35
36	0 35	01 26	difference	1 26	1031 40	difference	36 02	1031 40	36
37	0 36	01 29	difference	1 29	1060 05	difference	37 02	1060 05	37
38	0 37	01 33	difference	1 33	1088 70	difference	38 02	1088 70	38
39	0 38	01 36	difference	1 36	1117 35	difference	39 02	1117 35	39
40	0 39	01 40	difference	1 40	1146 00	difference	40 02	1146 00	40
41	0 40	01 43	difference	1 43	1174 65	difference	41 03	1174 65	41
42	0 41	01 47	difference	1 47	1203 30	difference	42 03	1203 30	42
43	0 42	01 50	difference	1 50	1231 95	difference	43 03	1231 95	43
44	0 43	01 54	difference	1 54	1260 60	difference	44 03	1260 60	44
45	0 44	01 57	difference	1 57	1289 25	difference	45 03	1289 25	45
46	0 45	01 61	difference	1 61	1317 90	difference	46 03	1317 90	46
47	0 46	01 64	difference	1 64	1346 55	difference	47 03	1346 55	47
48	0 47	01 68	difference	1 68	1375 20	difference	48 03	1375 20	48
49	0 48	01 71	difference	1 71	1403 85	difference	49 03	1403 85	49
50	0 49	01 75	difference	1 75	1432 50	difference	50 03	1432 50	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	2	88		2	88		2	88	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	59 96	1 78		1 78	1461 15		51 03	1461 15	51
52	51 00	1 82		1 82	1489 080		52 03	1489 080	52
53	52 00	1 85		1 85	1518 045		53 03	1518 045	53
54	53 00	1 89		1 89	1547 10		54 03	1547 10	54
55	54 00	1 92		1 92	1575 75		55 03	1575 75	55
56	55 00	1 96		1 96	1604 40		56 04	1604 40	56
57	56 00	1 99		1 99	1633 05		57 04	1633 05	57
58	57 00	2 02		2 02	1661 70		58 04	1661 70	58
59	58 00	2 06		2 06	1690 35		59 04	1690 35	59
60	59 00	2 10		2 10	1719 00		60 04	1719 00	60
61	60 00	2 13		2 13	1747 65		61 04	1747 65	61
62	61 00	2 17		2 17	1776 30		62 04	1776 30	62
63	62 00	2 20		2 20	1804 95		63 04	1804 95	63
64	63 00	2 24		2 24	1833 60		64 04	1833 60	64
65	64 00	2 27		2 27	1862 25		65 04	1862 25	65
66	65 00	2 31		2 31	1890 90		66 04	1890 90	66
67	66 00	2 34		2 34	1919 55		67 04	1919 55	67
68	67 00	2 38		2 38	1948 20		68 04	1948 20	68
69	68 00	2 41		2 41	1976 85		69 04	1976 85	69
70	69 00	2 45		2 45	2005 50		70 04	2005 50	70
71	70 00	2 48		2 48	2034 15		71 04	2034 15	71
72	71 00	2 52		2 52	2062 80		72 04	2062 80	72
73	72 00	2 55		2 55	2091 45		73 04	2091 45	73
74	73 00	2 59		2 59	2120 10		74 04	2120 10	74
75	74 00	2 62		2 62	2148 75		75 04	2148 75	75
76	75 00	2 66		2 66	2177 40		76 04	2177 40	76
77	76 00	2 69		2 69	2206 05		77 04	2206 05	77
78	77 00	2 73		2 73	2234 70		78 04	2234 70	78
79	78 00	2 76		2 76	2263 35		79 04	2263 35	79
80	79 00	2 80		2 80	2292 00		80 05	2292 00	80
81	80 00	2 83		2 83	2320 65		81 05	2320 65	81
82	81 00	2 87		2 87	2349 30		82 05	2349 30	82
83	82 00	2 90		2 90	2377 95		83 05	2377 95	83
84	83 00	2 94		2 94	2406 60		84 05	2406 60	84
85	84 00	2 97		2 97	2435 25		85 05	2435 25	85
86	85 00	3 01		3 01	2463 90		86 05	2463 90	86
87	86 00	3 04		3 04	2492 55		87 05	2492 55	87
88	87 00	3 08		3 08	2521 20		88 05	2521 20	88
89	88 00	3 11		3 11	2549 85		89 05	2549 85	89
90	89 00	3 15		3 15	2578 50		90 05	2578 50	90
91	90 00	3 18		3 18	2607 15		91 05	2607 15	91
92	91 00	3 22		3 22	2635 80		92 05	2635 80	92
93	92 00	3 25		3 25	2664 45		93 05	2664 45	93
94	93 00	3 29		3 29	2693 10		94 05	2693 10	94
95	94 00	3 32		3 32	2721 75		95 05	2721 75	95
96	95 00	3 36		3 36	2750 40		96 06	2750 40	96
97	96 00	3 39		3 39	2779 05		97 06	2779 05	97
98	97 00	3 43		3 43	2807 70		98 06	2807 70	98
99	98 00	3 46		3 46	2836 35		99 06	2836 35	99
100	99 00	3 50		3 50	2865 00		100 06	2865 00	100

7 Rhumb and three quarters is 87 deg. 11 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees	
	3	87		3	87		3	87
1	N. pts.	N. pts.	1	N. pts.	N. pts.	1	N. pts.	N. pts.
2	00 00	00 00	2	00 00	00 00	2	00 00	00 00
3	00 00	00 00	3	00 00	00 00	3	00 00	00 00
4	00 00	00 00	4	00 00	00 00	4	00 00	00 00
5	00 00	00 00	5	00 00	00 00	5	00 00	00 00
6	00 00	00 00	6	00 00	00 00	6	00 00	00 00
7	00 00	00 00	7	00 00	00 00	7	00 00	00 00
8	00 00	00 00	8	00 00	00 00	8	00 00	00 00
9	00 00	00 00	9	00 00	00 00	9	00 00	00 00
10	00 00	00 00	10	00 00	00 00	10	00 00	00 00
11	00 00	00 00	11	00 00	00 00	11	00 00	00 00
12	00 00	00 00	12	00 00	00 00	12	00 00	00 00
13	00 00	00 00	13	00 00	00 00	13	00 00	00 00
14	00 00	00 00	14	00 00	00 00	14	00 00	00 00
15	00 00	00 00	15	00 00	00 00	15	00 00	00 00
16	00 00	00 00	16	00 00	00 00	16	00 00	00 00
17	00 00	00 00	17	00 00	00 00	17	00 00	00 00
18	00 00	00 00	18	00 00	00 00	18	00 00	00 00
19	00 00	00 00	19	00 00	00 00	19	00 00	00 00
20	00 00	00 00	20	00 00	00 00	20	00 00	00 00
21	00 00	00 00	21	00 00	00 00	21	00 00	00 00
22	00 00	00 00	22	00 00	00 00	22	00 00	00 00
23	00 00	00 00	23	00 00	00 00	23	00 00	00 00
24	00 00	00 00	24	00 00	00 00	24	00 00	00 00
25	00 00	00 00	25	00 00	00 00	25	00 00	00 00
26	00 00	00 00	26	00 00	00 00	26	00 00	00 00
27	00 00	00 00	27	00 00	00 00	27	00 00	00 00
28	00 00	00 00	28	00 00	00 00	28	00 00	00 00
29	00 00	00 00	29	00 00	00 00	29	00 00	00 00
30	00 00	00 00	30	00 00	00 00	30	00 00	00 00
31	00 00	00 00	31	00 00	00 00	31	00 00	00 00
32	00 00	00 00	32	00 00	00 00	32	00 00	00 00
33	00 00	00 00	33	00 00	00 00	33	00 00	00 00
34	00 00	00 00	34	00 00	00 00	34	00 00	00 00
35	00 00	00 00	35	00 00	00 00	35	00 00	00 00
36	00 00	00 00	36	00 00	00 00	36	00 00	00 00
37	00 00	00 00	37	00 00	00 00	37	00 00	00 00
38	00 00	00 00	38	00 00	00 00	38	00 00	00 00
39	00 00	00 00	39	00 00	00 00	39	00 00	00 00
40	00 00	00 00	40	00 00	00 00	40	00 00	00 00
41	00 00	00 00	41	00 00	00 00	41	00 00	00 00
42	00 00	00 00	42	00 00	00 00	42	00 00	00 00
43	00 00	00 00	43	00 00	00 00	43	00 00	00 00
44	00 00	00 00	44	00 00	00 00	44	00 00	00 00
45	00 00	00 00	45	00 00	00 00	45	00 00	00 00
46	00 00	00 00	46	00 00	00 00	46	00 00	00 00
47	00 00	00 00	47	00 00	00 00	47	00 00	00 00
48	00 00	00 00	48	00 00	00 00	48	00 00	00 00
49	00 00	00 00	49	00 00	00 00	49	00 00	00 00
50	00 00	00 00	50	00 00	00 00	50	00 00	00 00

0 Rhumb and a quarter is 2 deg. 49 min.

7 Rhumb and three quarters is 87 deg. 11 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	3	87		3	87		3	87	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
15	50 93	02 67	15	02 67	0974 10	51	07 07	0974 10	51
16	51 50	02 72	16	02 72	0993 20	52	07 07	0993 20	52
17	52 50	02 78	17	02 78	1012 30	53	07 07	1012 30	53
18	53 52	02 84	18	02 84	1031 40	54	07 08	1031 40	54
19	54 52	02 89	19	02 89	1050 50	55	08 08	1050 50	55
20	55 52	02 94	20	02 94	1069 60	56	08 08	1069 60	56
21	56 52	03 00	21	03 00	1088 70	57	08 08	1088 70	57
22	57 52	03 05	22	03 05	1107 80	58	08 08	1100 80	58
23	58 52	03 11	23	03 11	1126 90	59	08 08	1126 90	59
24	59 52	03 15	24	03 15	1145 00	60	08 08	1145 00	60
25	60 91	03 20	25	03 20	1165 10	61	09 09	1165 10	61
26	61 91	03 25	26	03 25	1184 20	62	09 09	1184 20	62
27	62 91	03 31	27	03 31	1203 30	63	09 09	1203 30	63
28	63 91	03 45	28	03 36	1222 40	64	09 09	1222 40	64
29	64 91	03 41	29	03 41	1241 50	65	09 09	1241 50	65
30	65 91	03 47	30	03 47	1260 60	66	09 09	1260 60	66
31	66 91	03 52	31	03 52	1279 70	67	09 09	1279 70	67
32	67 91	03 57	32	03 57	1298 80	68	09 09	1298 80	68
33	68 91	03 62	33	03 62	1317 90	69	09 10	1317 90	69
34	69 91	03 68	34	03 68	1337 00	70	10 10	1337 00	70
35	70 91	03 73	35	03 73	1356 10	71	10 10	1356 10	71
36	71 91	03 78	36	03 78	1375 20	72	10 10	1375 20	72
37	72 91	03 83	37	03 83	1394 30	73	10 10	1394 30	73
38	73 91	03 89	38	03 89	1413 40	74	10 10	1413 40	74
39	74 89	03 94	39	03 94	1432 50	75	11 11	1432 50	75
40	75 89	04 00	40	04 00	1451 60	76	11 11	1451 60	76
41	76 89	04 05	41	04 05	1470 70	77	11 11	1470 70	77
42	77 89	04 10	42	04 10	1489 80	78	11 11	1489 80	78
43	78 89	04 15	43	04 15	1508 90	79	11 11	1508 90	79
44	79 89	04 20	44	04 20	1528 00	80	11 11	1528 00	80
45	80 89	04 25	45	04 25	1547 10	81	11 11	1547 10	81
46	81 88	04 30	46	04 30	1566 20	82	12 12	1566 20	82
47	82 88	04 36	47	04 36	1585 30	83	12 12	1585 30	83
48	83 88	04 41	48	04 41	1604 40	84	12 12	1604 40	84
49	84 88	04 46	49	04 46	1623 50	85	12 12	1623 50	85
50	85 88	04 51	50	04 51	1642 60	86	12 12	1642 60	86
51	86 88	04 57	51	04 57	1661 70	87	12 12	1661 70	87
52	87 88	04 62	52	04 62	1680 80	88	12 12	1680 80	88
53	88 87	04 67	53	04 67	1699 90	89	13 13	1699 90	89
54	89 87	04 72	54	04 72	1719 00	90	13 13	1719 00	90
55	90 87	04 78	55	04 78	1738 10	91	13 13	1738 10	91
56	91 87	04 84	56	04 84	1757 20	92	13 13	1757 20	92
57	92 87	04 89	57	04 89	1776 30	93	13 13	1776 30	93
58	93 87	04 94	58	04 94	1795 40	94	13 13	1795 40	94
59	94 87	05 00	59	05 00	1814 50	95	13 13	1814 50	95
60	95 86	05 05	60	05 5	1833 60	96	14 14	1833 60	96
61	96 86	05 10	61	05 10	1852 70	97	14 14	1852 70	97
62	97 86	05 15	62	05 15	1871 80	98	14 14	1871 80	98
63	98 86	05 20	63	05 20	1890 90	99	14 14	1890 90	99
64	99 86	05 25	64	05 25	1900 00	100	14 14	1910 00	100

o Rhumb and a quarter is 2 deg. 49 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	4	86		4	86		4	86	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00	00	1	00	14	1	00	14	1
2	01	01	2	01	28	2	01	28	2
3	02	02	3	02	42	3	01	43	3
4	03	03	4	03	57	4	01	57	4
5	04	04	5	03	71	5	01	71	5
6	05	05	6	04	85	6	01	85	6
7	06	06	7	04	100	7	02	100	7
8	07	07	8	05	114	8	02	114	8
9	08	08	9	05	128	9	02	129	9
10	09	09	10	06	143	10	02	143	10
11	10	10	11	07	157	11	03	157	11
12	11	11	12	08	171	12	03	172	12
13	12	12	13	09	185	13	03	186	13
14	13	13	14	10	200	14	03	200	14
15	14	14	15	11	214	15	04	215	15
16	15	15	16	12	228	16	04	229	16
17	16	16	17	13	243	17	04	243	17
18	17	17	18	14	257	18	04	258	18
19	18	18	19	15	271	19	05	272	19
20	19	19	20	16	286	20	05	286	20
21	20	20	21	17	300	21	05	301	21
22	21	21	22	18	314	22	06	315	22
23	22	22	23	19	328	23	06	328	23
24	23	23	24	20	342	24	06	344	24
25	24	24	25	21	357	25	06	358	25
26	25	25	26	22	371	26	06	372	26
27	26	26	27	23	386	27	07	387	27
28	27	27	28	24	400	28	07	401	28
29	28	28	29	25	414	29	07	415	29
30	29	29	30	26	429	30	07	430	30
31	30	30	31	27	443	31	08	444	31
32	31	31	32	28	457	32	08	458	32
33	32	32	33	29	471	33	08	473	33
34	33	33	34	30	486	34	09	487	34
35	34	34	35	31	500	35	09	501	35
36	35	35	36	32	514	36	09	516	36
37	36	36	37	33	529	37	09	530	37
38	37	37	38	34	543	38	09	544	38
39	38	38	39	35	557	39	10	556	39
40	39	39	40	36	572	40	10	573	40
41	40	40	41	37	586	41	10	587	41
42	41	41	42	38	600	42	10	602	42
43	42	42	43	39	614	43	11	616	43
44	43	43	44	40	629	44	11	630	44
45	44	44	45	41	643	45	11	645	45
46	45	45	46	42	657	46	11	659	46
47	46	46	47	43	672	47	12	673	47
48	47	47	48	44	686	48	12	688	48
49	48	48	49	45	700	49	12	702	49
50	49	49	50	46	715	50	12	717	50



Numbers	Sines Degrees			Tangents Degrees			Secants. Degrees.		Numbers
	4	86		4	86		4	86	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	50 87	03 57	03 57	729 30	51 12	731 34	51	12	51
52	51 0 87	03 54	03 0 64	743 0 60	52 0 12	745 0 63	52	0 12	52
53	52 0 87	03 51	03 0 71	757 0 90	53 0 13	760 0 02	53	0 13	53
54	53 0 87	03 0 78	03 0 78	772 0 20	54 0 13	774 0 36	54	0 13	54
55	54 86	03 85	03 85	786 50	55 13	788 70	55	13	55
56	55 86	03 92	03 92	800 80	56 13	803 04	56	13	56
57	56 86	03 99	03 1 99	815 0 10	57 0 14	817 0 38	57	0 14	57
58	57 86	04 0 06	04 0 06	829 0 40	58 0 14	831 0 72	58	0 14	58
59	58 86	04 13	04 1 13	845 0 70	59 0 14	846 0 06	59	0 14	59
60	59 85	04 20	04 20	858 00	60 14	860 40	60	14	60
61	60 85	04 27	04 27	872 30	61 15	874 74	61	15	61
62	61 85	04 34	04 1 34	886 0 60	62 0 15	889 0 08	62	0 15	62
63	62 84	04 41	04 1 41	900 0 90	63 0 15	903 0 42	63	0 15	63
64	63 84	04 48	04 1 48	915 0 20	64 0 15	917 0 76	64	0 15	64
65	64 84	04 55	04 55	929 50	65 16	932 10	65	16	65
66	65 84	04 62	04 62	943 80	66 16	946 44	66	16	66
67	66 83	04 69	04 1 69	958 0 10	67 0 16	960 0 78	67	0 16	67
68	67 83	04 76	04 1 76	972 0 40	68 0 16	975 12	68	0 16	68
69	68 83	04 83	04 1 83	986 0 70	69 0 17	989 0 46	69	0 17	69
70	69 83	04 90	04 90	1001 00	70 17	1003 80	70	17	70
71	70 82	04 97	04 97	1015 30	71 17	1018 14	71	17	71
72	71 82	05 04	05 04	1029 0 60	72 0 17	1032 0 48	72	0 17	72
73	72 82	05 11	05 11	1043 0 90	73 0 18	1046 0 82	73	0 18	73
74	73 82	05 18	05 1 18	1058 0 20	74 0 18	1061 0 16	74	0 18	74
75	74 82	05 25	05 25	1072 50	75 18	1075 50	75	18	75
76	75 81	05 32	05 32	1086 80	76 18	1089 84	76	18	76
77	76 81	05 39	05 1 09	1101 0 10	77 0 19	1104 0 18	77	0 19	77
78	77 81	05 46	05 1 46	1115 0 40	78 0 19	1118 0 52	78	0 19	78
79	78 81	05 53	05 1 53	1129 0 70	79 0 19	1132 0 82	79	0 19	79
80	79 80	05 60	05 60	1144 00	80 19	1147 16	80	19	80
81	80 80	05 67	05 67	1158 30	81 20	1161 54	81	20	81
82	81 80	05 74	05 1 74	1172 0 60	82 20	1175 0 88	82	20	82
83	82 80	05 81	05 1 81	1186 0 90	83 20	1190 0 22	83	20	83
84	83 79	05 88	05 1 88	1201 0 20	84 20	1204 0 56	84	20	84
85	84 79	05 95	05 95	1215 50	85 21	1218 50	85	21	85
86	85 79	06 02	06 02	1229 80	86 21	1233 24	86	21	86
87	86 79	06 09	06 1 09	1244 0 10	87 21	1247 0 58	87	21	87
88	87 78	06 16	06 1 16	1258 0 40	88 21	1261 0 52	88	21	88
89	88 78	06 23	06 1 23	1272 0 70	89 22	1276 0 26	89	22	89
90	89 78	06 30	06 30	1287 00	90 22	1290 60	90	22	90
91	90 78	06 37	06 37	1301 30	91 22	1304 94	91	22	91
92	91 77	06 44	06 1 44	1315 0 60	92 22	1319 0 26	92	22	92
93	92 77	06 51	06 1 51	1329 0 90	93 23	1333 62	93	23	93
94	93 77	06 58	06 1 58	1344 0 20	94 23	1347 0 96	94	23	94
95	94 77	06 65	06 65	1358 50	95 23	1362 30	95	23	95
96	95 76	06 72	06 72	1372 80	96 23	1376 64	96	23	96
97	96 76	06 79	06 1 79	1387 0 10	97 24	1390 0 58	97	24	97
98	97 76	06 86	06 1 86	1401 0 40	98 24	1405 1 32	98	24	98
99	98 76	06 93	06 1 93	1415 0 70	99 24	1419 0 66	99	24	99
100	99 76	07 00	07 00	1430 00	100 24	1434 00	100	24	100



Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	s	8s		s	8s		s	8s	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 00	00 00	00 00	00 00	11 43	11 43	11 01	11 43	1
2	01 39	00 17	00 00	00 17	22 86	22 86	01 01	22 86	2
3	02 58	00 26	00 00	00 26	34 29	34 29	01 01	34 44	3
4	03 58	00 35	00 00	00 35	45 72	45 72	02 02	45 92	4
5	04 58	00 44	00 00	00 44	57 15	57 15	02 02	57 40	5
6	05 58	00 52	00 00	00 52	68 58	68 58	02 02	68 83	6
7	06 57	00 61	00 00	00 61	80 01	80 01	03 03	80 36	7
8	07 57	00 70	00 00	00 70	91 44	91 44	03 03	91 32	8
9	08 57	00 79	00 00	00 79	102 87	102 87	03 03	103 32	9
10	09 56	00 87	00 00	00 87	114 30	114 30	04 04	114 80	10
11	10 56	00 96	00 00	00 96	125 73	125 73	11 04	126 28	11
12	11 56	01 05	01 00	01 05	137 16	137 16	12 04	137 75	12
13	12 55	01 14	01 00	01 14	148 59	148 59	13 05	149 24	13
14	13 55	01 22	01 00	01 22	160 02	160 02	14 05	160 72	14
15	14 55	01 31	01 00	01 31	171 45	171 45	15 05	172 20	15
16	15 54	01 40	01 00	01 40	182 88	182 88	16 06	183 68	16
17	16 54	01 49	01 00	01 49	194 31	194 31	17 06	195 16	17
18	17 53	01 57	01 00	01 57	205 74	205 74	18 06	206 56	18
19	18 53	01 66	01 00	01 66	217 17	217 17	19 07	218 12	19
20	19 52	01 75	01 00	01 75	228 60	228 60	20 08	229 60	20
21	20 52	01 84	01 00	01 84	240 03	240 03	21 08	241 08	21
22	21 52	01 92	01 00	01 92	251 46	251 46	22 08	252 56	22
23	22 51	02 01	02 00	02 01	262 89	262 89	23 09	264 04	23
24	23 51	02 10	02 00	02 10	274 32	274 32	24 09	275 52	24
25	24 51	02 19	02 00	02 19	285 75	285 75	25 09	287 00	25
26	25 50	02 27	02 00	02 27	297 18	297 18	26 10	298 48	26
27	26 50	02 36	02 00	02 36	308 61	308 61	27 10	309 96	27
28	27 50	02 45	02 00	02 45	320 04	320 04	28 10	321 44	28
29	28 49	02 54	02 00	02 54	331 47	331 47	29 11	332 92	29
30	29 49	02 62	02 00	02 62	342 90	342 90	30 11	344 40	30
31	30 48	02 71	02 00	02 71	354 33	354 33	31 11	355 88	31
32	31 48	02 80	02 00	02 80	365 76	365 76	32 12	367 36	32
33	32 48	02 89	02 00	02 89	377 19	377 19	33 12	378 84	33
34	33 48	02 97	02 00	02 97	388 62	388 62	34 12	390 32	34
35	34 47	03 06	03 00	03 06	400 05	400 05	35 13	401 80	35
36	35 47	03 15	03 00	03 15	411 48	411 48	36 13	413 28	36
37	36 46	03 24	03 00	03 24	422 91	422 91	37 14	424 75	37
38	37 46	03 32	03 00	03 32	434 34	434 34	38 14	436 20	38
39	38 45	03 41	03 00	03 41	445 77	445 77	39 14	447 72	39
40	39 45	03 50	03 00	03 50	457 20	457 20	40 15	459 20	40
41	40 45	03 59	03 00	03 59	468 63	468 63	41 15	470 63	41
42	41 45	03 67	03 00	03 67	480 06	480 06	42 15	482 16	42
43	42 45	03 76	03 00	03 76	491 49	491 49	43 16	493 54	43
44	43 45	03 85	03 00	03 85	502 92	502 92	44 16	505 51	44
45	44 45	03 94	03 00	03 94	514 35	514 35	45 16	516 60	45
46	45 45	04 02	04 00	04 02	525 78	525 78	46 17	528 08	46
47	46 45	04 11	04 00	04 11	537 21	537 21	47 17	539 56	47
48	47 45	04 20	04 00	04 20	548 64	548 64	48 18	551 04	48
49	48 45	04 29	04 00	04 29	560 07	560 07	49 18	562 52	49
50	49 45	04 37	04 00	04 37	571 50	571 50	50 19	574 00	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers			
	s	8s		s	8s		s	8s				
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.				
51	50 81	04 45		04 45	582 93		51 19	585 48	51			
52	51 08	04 05 54		04 05 54	594 03 6		52 01 9	595 05 6	52			
53	52 08 80	04 06 62		04 06 62	605 23 79		53 02 20	608 24 44	53			
54	53 08 04	04 07 71		04 71	617 22 22		54 20	619 22 22	54			
55	54 79	04 80		04 80	628 65		55 21	631 40	55			
56	55 79	04 89		04 89	640 08		56 21	642 88	56			
57	56 79	04 98		04 98	651 05 1		57 02 22	654 03 6	57			
58	57 78	05 07		05 07	662 94		58 22	665 84	58			
59	58 78	05 16		05 16	674 37		59 22	677 32	59			
60	59 77	05 25		05 25	685 80		60 23	688 80	60			
61	60 77	05 34		05 34	697 23		61 23	700 28	61			
62	61 76	05 42		05 42	708 06 6		62 24	711 07 6	62			
63	62 76	05 51		05 51	720 09		63 24	723 21	63			
64	63 76	05 60		05 60	731 05 52		64 24	734 05 72	64			
65	64 75	05 69		05 69	742 95		65 25	745 20	65			
66	65 75	05 77		05 77	754 38		66 27	757 68	66			
67	66 74	05 86		05 86	765 08 1		67 27	769 01 6	67			
68	67 74	05 95		05 95	777 24		68 28	780 54	68			
69	68 74	06 04		06 04	788 56 7		69 28	792 16	69			
70	69 73	06 12		06 12	800 10		70 28	803 60	70			
71	70 73	06 21		06 21	811 53		71 27	815 08	71			
72	71 73	06 30		06 30	822 09 6		72 27	826 05 6	72			
73	72 72	06 39		06 39	834 03 39		73 28	838 00 4	73			
74	73 72	06 47		06 47	845 20 82		74 28	849 22 74	74			
75	74 72	06 56		06 56	857 25		75 28	861 00	75			
76	75 71	06 65		06 65	868 68		76 29	872 48	76			
77	76 71	06 74		06 74	880 01 11		77 29	883 05 6	77			
78	77 71	06 82		06 82	891 44 54		78 29	895 44	78			
79	78 70	06 91		06 91	902 23 97		79 30	906 23 92	79			
80	79 70	07 00		07 00	914 40		80 30	918 40	80			
81	80 70	07 09		07 09	925 83		81 30	929 88	81			
82	81 69	07 17		07 17	937 02 26		82 31	941 03 6	82			
83	82 69	07 26		07 26	948 38 69		83 31	952 08 4	83			
84	83 68	07 35		07 35	960 21 12		84 32	963 23 32	84			
85	84 68	07 44		07 44	971 55		85 32	975 80	85			
86	85 68	07 52		07 52	982 93		86 32	987 28	86			
87	86 67	07 61		07 61	994 04 1		87 33	998 07 6	87			
88	87 67	07 70		07 70	1005 23 84		88 33	1010 24	88			
89	88 67	07 79		07 79	1017 22 27		89 33	1021 27 2	89			
90	89 66	07 87		07 87	1028 70		90 34	1033 20	90			
91	90 66	07 96		07 96	1040 13		91 34	1045 68	91			
92	91 65	08 05		08 05	1051 05 6		92 35	1057 01 6	92			
93	92 65	08 14		08 14	1062 23 99		93 35	1068 24 64	93			
94	93 65	08 22		08 22	1074 24 42		94 35	1080 21 12	94			
95	94 64	08 31		08 31	1085 85		95 36	1091 60	95			
96	95 64	08 40		08 40	1097 28		96 36	1103 08	96			
97	96 63	08 49		08 49	1108 07 1		97 37	1114 05 6	97			
98	97 63	08 57		08 57	1120 14		98 37	1126 04	98			
99	98 62	09 06		08 66	1131 57		99 38	1137 25 52	99			
100	99 62	09 15		09 75	1143 00		100 38	1148 00	100			

7 Rhumb and a half is 84 deg. 22 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	6	84		6	84		6	84	
1	N. pts.	N. pts.	1	N. pts.	N. pts.	1	N. pts.	N. pts.	1
2	01 59	00 10	2	01 11	00 09	2	01 57	00 13	2
3	02 58	00 11	3	02 21	00 10	3	02 56	00 13	3
4	03 58	00 12	4	03 32	00 11	4	03 55	00 14	4
5	04 57	00 12	5	04 42	00 12	5	04 53	00 15	5
6	05 57	00 13	6	05 53	00 13	6	05 57	00 16	6
7	06 56	00 14	7	06 53	00 14	7	06 56	00 17	7
8	07 56	00 15	8	07 53	00 15	8	07 56	00 18	8
9	08 55	00 16	9	08 53	00 16	9	08 55	00 19	9
10	09 55	00 17	10	09 53	00 17	10	09 55	00 20	10
11	10 54	00 18	11	10 53	00 18	11	10 54	00 21	11
12	11 53	00 19	12	11 53	00 19	12	11 53	00 22	12
13	12 53	00 20	13	12 53	00 20	13	12 53	00 23	13
14	13 52	00 21	14	13 52	00 21	14	13 52	00 24	14
15	14 52	00 22	15	14 52	00 22	15	14 52	00 25	15
16	15 51	00 23	16	15 51	00 23	16	15 51	00 26	16
17	16 51	00 24	17	16 51	00 24	17	16 51	00 27	17
18	17 50	00 25	18	17 50	00 25	18	17 50	00 28	18
19	18 50	00 26	19	18 50	00 26	19	18 50	00 29	19
20	19 49	00 27	20	19 49	00 27	20	19 49	00 30	20
21	20 49	00 28	21	20 49	00 28	21	20 49	00 31	21
22	21 48	00 29	22	21 48	00 29	22	21 48	00 32	22
23	22 48	00 30	23	22 48	00 30	23	22 48	00 33	23
24	23 47	00 31	24	23 47	00 31	24	23 47	00 34	24
25	24 47	00 32	25	24 47	00 32	25	24 47	00 35	25
26	25 46	00 33	26	25 46	00 33	26	25 46	00 36	26
27	26 46	00 34	27	26 46	00 34	27	26 46	00 37	27
28	27 45	00 35	28	27 45	00 35	28	27 45	00 38	28
29	28 45	00 36	29	28 45	00 36	29	28 45	00 39	29
30	29 44	00 37	30	29 44	00 37	30	29 44	00 40	30
31	30 44	00 38	31	30 44	00 38	31	30 44	00 41	31
32	31 43	00 39	32	31 43	00 39	32	31 43	00 42	32
33	32 43	00 40	33	32 43	00 40	33	32 43	00 43	33
34	33 42	00 41	34	33 42	00 41	34	33 42	00 44	34
35	34 42	00 42	35	34 42	00 42	35	34 42	00 45	35
36	35 41	00 43	36	35 41	00 43	36	35 41	00 46	36
37	36 41	00 44	37	36 41	00 44	37	36 41	00 47	37
38	37 40	00 45	38	37 40	00 45	38	37 40	00 48	38
39	38 40	00 46	39	38 40	00 46	39	38 40	00 49	39
40	39 39	00 47	40	39 39	00 47	40	39 39	00 50	40
41	40 39	00 48	41	40 39	00 48	41	40 39	00 51	41
42	41 38	00 49	42	41 38	00 49	42	41 38	00 52	42
43	42 38	00 50	43	42 38	00 50	43	42 38	00 53	43
44	43 37	00 51	44	43 37	00 51	44	43 37	00 54	44
45	44 37	00 52	45	44 37	00 52	45	44 37	00 55	45
46	45 36	00 53	46	45 36	00 53	46	45 36	00 56	46
47	46 36	00 54	47	46 36	00 54	47	46 36	00 57	47
48	47 35	00 55	48	47 35	00 55	48	47 35	00 58	48
49	48 35	00 56	49	48 35	00 56	49	48 35	00 59	49
50	49 34	00 57	50	49 34	00 57	50	49 34	00 60	50

OR Rhumb and a half is 5 deg. 37 min.

o Rhumb and a half is 5 degs. 37 min. and a half.

Numbers	Sines Degrées			Tangents Degrées			Secants Degrées		Numbers
	6	84		6	84		6	84	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
15	50 72	05 33		05 36	485 26		51 20	487 91	51
16	51 07	05 43		05 46	494 078		52 029	497 048	52
17	52 07	05 54		05 57	504 202		53 29	507 004	53
18	53 07	05 64		05 67	513 108		54 30	516 061	54
19	54 07	05 77		05 78	523 32		55 30	525 18	55
20	55 09	05 85		05 88	532 84		56 31	535 74	56
21	56 09	05 96		05 99	542 35		57 31	545 31	57
22	57 09	06 06		06 02	551 11		58 32	554 88	58
23	58 09	06 17		06 20	559 138		59 32	564 145	59
24	59 07	06 27		06 31	570 90		60 33	574 01	60
25	60 06	06 37		06 41	580 41		61 34	583 50	61
26	61 06	06 48		06 52	589 93		62 35	593 14	62
27	62 06	06 58		06 59	599 44		63 35	602 71	63
28	63 06	07 09		07 01	608 96		64 36	612 28	64
29	64 06	07 19		07 08	618 47		65 36	621 81	65
30	65 06	07 29		07 14	627 99		66 37	631 41	66
31	66 06	07 39		07 15	637 50		67 37	640 99	67
32	67 06	07 49		07 25	647 02		68 38	650 55	68
33	68 06	07 59		07 30	656 53		69 38	660 11	69
34	69 06	08 09		07 36	666 05		70 39	669 68	70
35	70 06	08 19		07 46	675 55		71 39	679 24	71
36	71 06	08 29		07 57	685 08		72 40	688 81	72
37	72 06	08 39		07 57	694 59		73 40	698 38	73
38	73 06	08 49		07 59	704 11		74 41	707 94	74
39	74 06	08 59		07 59	713 62		75 41	717 51	75
40	75 06	09 09		08 01	723 14		76 42	727 06	76
41	76 06	09 19		08 09	732 65		77 42	736 65	77
42	77 06	09 29		08 20	742 17		78 43	746 21	78
43	78 06	09 39		08 31	751 68		79 43	755 78	79
44	79 06	09 49		08 41	761 20		80 44	765 34	80
45	80 06	09 59		08 51	770 70		81 45	774 91	81
46	81 06	10 09		08 59	780 23		82 46	784 04	82
47	82 06	10 19		09 01	789 74		83 46	794 08	83
48	83 06	10 29		09 05	799 26		84 47	803 61	84
49	84 06	10 39		09 08	808 77		85 47	813 18	85
50	85 06	10 49		09 09	818 29		86 48	822 75	86
51	86 06	10 59		09 14	827 80		87 48	832 31	87
52	87 06	11 09		09 25	837 32		88 49	841 88	88
53	88 06	11 19		09 39	846 83		89 50	851 44	89
54	89 06	11 29		09 46	856 35		90 50	861 01	90
55	90 06	11 39		09 56	865 86		91 50	870 50	91
56	91 06	11 49		09 59	875 38		92 51	880 14	92
57	92 06	11 59		09 59	884 89		93 51	889 71	93
58	93 06	12 09		09 59	894 41		94 52	899 28	94
59	94 06	12 19		09 59	903 92		95 52	908 85	95
60	95 06	12 29		10 09	913 44		96 53	918 41	96
61	96 06	12 39		10 19	922 95		97 53	927 98	97
62	97 06	12 49		10 30	932 47		98 53	937 51	98
63	98 06	12 59		10 40	941 98		99 54	947 11	99
64	99 06	13 09		10 51	951 50		100 55	956 68	100

7 Rhumb and a half is 84 degs. 22 min.

Numbers	Sines Degrees.			Tangents Degrees			Secants Degrees		Numbers
	7	83		7	83		7	8	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 99	00 12	difference	00 12	8 14	difference	1 01	8 21	1
2	01 99	00 24		00 25	16 29		2 01	16 41	2
3	02 98	00 37		00 37	24 43		3 02	24 52	3
4	03 97	00 49		00 49	32 58		4 03	32 58	4
5	04 96	00 61		00 61	40 72		5 04	41 03	5
6	05 96	00 73		00 74	48 87		6 04	49 23	6
7	06 95	00 85		00 86	57 01		7 05	57 08	7
8	07 94	00 98		00 93	65 15		8 06	65 14	8
9	08 93	01 10		01 14	73 30		9 07	73 05	9
10	09 92	01 22		01 23	81 44		10 08	82 06	10
11	10 92	01 34		01 35	89 59		11 08	90 26	11
12	11 91	01 47		01 47	97 73		12 09	98 04	12
13	12 90	01 59		01 50	105 88		13 10	105 57	13
14	13 89	02 11		02 22	114 02		14 11	114 18	14
15	14 89	02 23		02 34	122 16		15 11	123 08	15
16	15 88	02 35		02 45	130 31		16 12	131 29	16
17	16 87	02 47		02 56	138 45		17 13	139 09	17
18	17 86	02 59		03 07	146 60		18 14	147 10	18
19	18 85	03 11		03 17	154 74		19 14	155 19	19
20	19 85	03 23		03 28	162 89		20 15	164 11	20
21	20 84	03 35		03 38	171 03		21 16	172 31	21
22	21 83	03 47		03 49	179 17		22 17	180 52	22
23	22 83	03 59		03 59	187 32		23 17	188 77	23
24	23 82	04 11		04 01	195 46		24 18	196 53	24
25	24 81	04 23		04 07	203 61		25 19	205 13	25
26	25 80	04 35		04 19	211 75		26 20	213 34	26
27	26 80	04 47		04 31	219 90		27 20	221 54	27
28	27 79	04 59		04 44	228 04		28 21	229 75	28
29	28 78	05 11		04 56	236 18		29 22	237 55	29
30	29 78	05 23		05 08	244 33		30 22	245 16	30
31	30 77	05 35		05 19	252 47		31 23	254 37	31
32	31 76	05 47		05 31	260 62		32 24	262 57	32
33	32 75	05 59		05 43	268 76		33 25	270 78	33
34	33 74	06 11		05 55	276 91		34 26	278 58	34
35	34 73	06 23		06 07	285 05		35 26	287 19	35
36	35 73	06 35		06 19	293 19		36 27	295 39	36
37	36 72	06 47		06 31	301 34		37 28	303 50	37
38	37 72	06 59		06 43	309 48		38 28	311 50	38
39	38 71	07 11		06 55	317 63		39 29	320 01	39
40	39 70	07 23		07 07	325 77		40 30	328 22	40
41	40 69	07 35		07 19	333 92		41 31	336 42	41
42	41 69	07 47		07 31	342 05		42 31	344 52	42
43	42 68	07 59		07 43	350 20		43 32	352 58	43
44	43 67	08 11		07 55	358 35		44 33	361 03	44
45	44 66	08 23		08 07	366 49		45 34	369 24	45
46	45 66	08 35		08 19	374 64		46 34	377 45	46
47	46 65	08 47		08 31	382 78		47 35	385 55	47
48	47 64	08 59		08 43	390 93		48 35	393 58	48
49	48 63	09 11		08 55	399 07		49 37	402 57	49
50	49 63	09 23		09 07	407 22		50 37	410 28	50



Numbers	Sines Degrees			Tangents Degrees			Secants. Degrees.		Numbers
	7	83		7	83		7	83	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	50 62	06 22		06 27	415 36		51 39	418 48	51
52	51 61	06 34		06 39	423 50		52 38	426 59	52
53	52 60	06 47		06 51	431 55		53 37	434 19	53
54	53 60	06 59		06 54	439 79		54 36	442 10	54
55	54 59	06 71		06 75	447 94		55 35	451 30	55
56	55 58	06 73		06 88	455 08		56 34	459 51	56
57	56 57	06 95		07 01	464 22		57 33	467 71	57
58	57 56	07 08		07 13	472 37		58 32	475 92	58
59	58 55	07 20		07 25	480 51		59 31	484 12	59
60	59 55	07 32		07 37	488 66		60 30	492 33	60
61	60 54	07 44		07 50	496 80		61 29	500 53	61
62	61 53	07 57		07 52	504 95		62 28	508 74	62
63	62 53	07 69		07 74	513 09		63 27	516 94	63
64	63 52	07 81		07 86	521 23		64 26	525 15	64
65	64 51	07 93		07 99	529 38		65 25	533 35	65
66	65 51	08 05		08 11	537 52		66 24	541 56	66
67	66 50	08 18		08 17	545 67		67 23	549 76	67
68	67 49	08 30		08 23	553 81		68 22	557 97	68
69	68 48	08 42		08 28	561 96		69 21	566 17	69
70	69 47	08 54		08 33	570 10		70 20	574 38	70
71	70 46	08 67		08 38	578 24		71 19	582 59	71
72	71 45	08 79		08 43	586 39		72 18	590 79	72
73	72 45	08 91		08 48	594 53		73 17	599 05	73
74	73 44	09 03		09 09	602 68		74 16	607 20	74
75	74 44	09 15		09 14	610 82		75 15	615 41	75
76	75 43	09 28		09 19	618 97		76 14	623 61	76
77	76 42	09 40		09 24	627 11		77 13	631 82	77
78	77 42	09 52		09 29	635 25		78 12	640 02	78
79	78 41	09 64		09 34	643 40		79 11	648 23	79
80	79 40	09 76		09 39	651 54		80 10	656 44	80
81	80 39	09 88		09 44	659 69		81 09	664 64	81
82	81 38	09 50		10 00	667 83		82 08	672 85	82
83	82 37	10 02		10 05	675 97		83 07	681 05	83
84	83 36	10 14		10 10	684 12		84 06	689 12	84
85	84 35	10 27		10 15	692 26		85 05	697 46	85
86	85 34	10 39		10 20	700 41		86 04	705 67	86
87	86 33	10 51		10 25	708 55		87 03	713 87	87
88	87 32	10 73		10 30	716 70		88 02	722 08	88
89	88 31	10 86		10 35	724 84		89 01	730 28	89
90	89 30	10 98		11 00	732 98		90 00	738 49	90
91	90 29	11 10		11 05	741 13		91 59	746 69	91
92	91 28	11 23		11 10	749 27		92 58	754 90	92
93	92 27	11 35		11 15	757 42		93 57	763 10	93
94	93 26	11 47		11 20	765 56		94 56	771 31	94
95	94 25	11 59		11 25	773 71		95 55	779 52	95
96	95 24	12 11		11 30	781 85		96 54	787 72	96
97	96 23	12 23		11 35	789 99		97 53	795 93	97
98	97 22	12 36		12 00	798 14		98 52	804 13	98
99	98 21	12 48		12 05	806 28		99 51	812 34	99
100	99 20	12 60		12 10	814 42		100 50	820 55	100



o Rhumb three quarters is 8 deg. 26 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	8	12		8	82		8	82	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 00	00 14	1	00 14	7 12	1	01 01	7 18	1
2	01 01	01 28	2	01 28	14 23	2	02 02	14 37	2
3	02 02	02 42	3	02 42	21 35	3	03 03	21 50	3
4	03 03	03 56	4	03 56	28 46	4	04 04	28 57	4
5	04 05	04 70	5	04 70	35 58	5	05 05	35 52	5
6	05 05	05 84	6	05 84	42 69	6	06 06	43 11	6
7	06 06	06 97	7	06 97	49 08	7	07 07	50 30	7
8	07 07	07 11	8	07 11	56 02	8	08 08	57 48	8
9	08 08	08 25	9	08 25	62 04	9	09 09	64 09	9
10	09 09	09 39	10	09 39	67 15	10	10 10	71 85	10
11	10 82	01 53	11	10 82	78 26	11	11 11	79 00	11
12	11 88	01 58	12	11 88	85 38	12	12 12	86 22	12
13	12 87	01 58	13	12 87	92 50	13	13 13	93 42	13
14	13 86	01 55	14	13 86	99 31	14	14 14	100 17	14
15	14 85	02 09	15	14 85	105 73	15	15 15	107 78	15
16	15 84	02 23	16	15 84	113 84	16	16 16	114 96	16
17	16 83	02 33	17	16 83	120 96	17	17 17	122 15	17
18	17 82	02 50	18	17 82	128 07	18	18 18	129 33	18
19	18 81	02 64	19	18 81	135 19	19	19 19	136 52	19
20	19 80	02 75	20	19 80	142 30	20	20 20	143 70	20
21	20 80	02 92	21	20 80	149 42	21	21 21	150 88	21
22	21 79	03 06	22	21 79	156 53	22	22 22	158 07	22
23	22 78	03 39	23	22 78	163 65	23	23 23	169 26	23
24	23 77	03 34	24	23 77	170 35	24	24 24	172 44	24
25	24 76	03 48	25	24 76	177 88	25	25 25	179 62	25
26	25 75	03 62	26	25 75	184 99	26	26 26	186 81	26
27	26 74	03 75	27	26 74	192 11	27	27 27	194 00	27
28	27 73	03 85	28	27 73	199 22	28	28 28	201 18	28
29	28 72	04 03	29	28 72	206 34	29	29 29	203 37	29
30	29 71	04 17	30	29 71	213 46	30	30 30	215 56	30
31	30 70	04 31	31	30 70	220 57	31	31 31	222 27	31
32	31 69	04 45	32	31 69	227 69	32	32 32	229 03	32
33	32 68	04 59	33	32 68	234 81	33	33 33	237 15	33
34	33 67	04 73	34	33 67	241 92	34	34 34	244 30	34
35	34 66	04 87	35	34 66	249 04	35	35 35	251 49	35
36	35 65	05 01	36	35 65	256 15	36	36 36	258 67	36
37	36 64	05 15	37	36 64	263 27	37	37 37	265 86	37
38	37 63	05 29	38	37 63	270 38	38	38 38	273 04	38
39	38 62	05 43	39	38 62	277 58	39	39 39	280 23	39
40	39 61	05 57	40	39 61	284 61	40	40 40	287 41	40
41	40 60	05 71	41	40 60	291 73	41	41 41	294 59	41
42	41 59	05 85	42	41 59	298 84	42	42 42	301 78	42
43	42 58	05 98	43	42 58	305 95	43	43 43	308 97	43
44	43 57	06 12	44	43 57	313 07	44	44 44	316 15	44
45	44 56	06 26	45	44 56	320 29	45	45 45	323 33	45
46	45 55	06 40	46	45 55	327 30	46	46 46	330 52	46
47	46 54	06 54	47	46 54	334 42	47	47 47	337 71	47
48	47 53	06 68	48	47 53	341 53	48	48 48	344 89	48
49	48 52	06 82	49	48 52	348 65	49	49 49	352 08	49
50	49 51	06 56	50	49 51	355 77	50	50 50	359 27	50

o Rhumb three quarters is 8 deg. 26 min.

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	8	82		8	82		8	82	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	50 51	07 10	07 17	362 88	51 50	366 45	51	50	51
52	51 50	07 24	07 31	370 00	52 01	373 64	52	51	52
53	52 49	07 37	07 45	377 12	53 02	380 82	53	52	53
54	53 48	07 51	07 59	384 23	54 03	387 99	54	53	54
55	54 47	07 65	07 73	391 35	55 04	395 19	55	54	55
56	55 46	07 79	07 87	498 46	56 05	402 38	56	55	56
57	56 45	07 93	08 01	405 58	57 06	409 57	57	56	57
58	57 44	08 07	08 15	412 69	58 07	416 75	58	57	58
59	58 43	08 21	08 29	419 81	59 08	423 84	59	58	59
60	59 42	08 35	08 43	426 92	60 09	431 12	60	59	60
61	60 41	08 49	08 57	434 04	61 10	438 30	61	60	61
62	61 40	08 53	08 55	441 15	62 11	445 49	62	61	62
63	62 39	08 56	08 58	448 27	63 12	452 68	63	62	63
64	63 38	09 00	08 59	455 38	64 13	459 86	64	63	64
65	64 37	09 04	09 14	462 50	65 14	467 04	65	64	65
66	65 36	09 18	09 28	469 61	66 15	474 23	66	65	66
67	66 35	09 32	09 42	476 73	67 16	481 42	67	66	67
68	67 34	09 46	09 56	483 84	68 17	488 60	68	67	68
69	68 33	09 50	09 52	490 96	69 18	495 79	69	68	69
70	69 32	09 74	09 84	498 08	70 19	502 97	70	69	70
71	70 31	09 88	09 98	505 19	71 20	510 15	71	70	71
72	71 30	10 02	10 12	512 31	72 21	517 34	72	71	72
73	72 29	10 16	10 26	519 43	73 22	524 52	73	72	73
74	73 28	10 30	10 31	526 54	74 23	531 70	74	73	74
75	74 27	10 44	10 54	533 66	75 24	538 89	75	74	75
76	75 26	10 58	10 68	540 77	76 25	546 08	76	75	76
77	76 25	10 72	10 82	547 89	77 26	553 27	77	76	77
78	77 24	10 86	10 96	555 00	78 27	560 45	78	77	78
79	78 23	10 99	11 09	562 12	79 28	567 64	79	78	79
80	79 22	11 13	11 24	569 23	80 29	574 82	80	79	80
81	80 21	11 27	11 38	576 35	81 30	582 00	81	80	81
82	81 20	11 41	11 52	583 46	82 31	589 19	82	81	82
83	82 19	11 55	11 65	590 58	83 32	596 38	83	82	83
84	83 18	11 69	11 80	597 70	84 33	603 56	84	83	84
85	84 17	11 83	11 95	604 81	85 34	610 74	85	84	85
86	85 16	11 97	12 09	611 92	86 35	617 93	86	85	86
87	86 15	12 11	12 23	619 04	87 36	625 12	87	86	87
88	87 14	12 25	12 37	626 15	88 37	632 30	88	87	88
89	88 13	12 38	12 51	633 27	89 38	639 49	89	88	89
90	89 12	12 53	12 65	640 38	90 39	646 68	90	89	90
91	90 11	12 66	12 79	647 50	91 40	653 85	91	90	91
92	91 10	12 80	12 93	654 62	92 41	661 05	92	91	92
93	92 09	12 94	13 07	661 74	93 42	668 23	93	92	93
94	93 08	13 08	13 21	668 85	94 43	675 41	94	93	94
95	94 07	13 22	13 35	675 97	95 44	682 60	95	94	95
96	95 06	13 36	13 49	683 08	96 45	689 79	96	95	96
97	96 05	13 50	13 63	690 20	97 46	696 98	97	96	97
98	97 04	13 54	13 77	697 31	98 47	704 16	98	97	98
99	98 03	13 57	13 91	704 43	99 48	711 35	99	98	99
100	99 03	13 52	14 05	711 54	100 49	718 53	100	99	100

7 Rhumb and a quarter, is 8 1 deg. 34 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	9	81		9	81		9	81	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00° 00'	00° 00'	1	00° 00'	00° 00'	1	01° 02'	6° 39'	1
2	01° 02'	00° 00'	2	01° 02'	00° 00'	2	01° 03'	12° 08'	2
3	02° 06'	00° 00'	3	02° 06'	00° 00'	3	01° 04'	19° 18'	3
4	03° 05'	00° 00'	4	03° 05'	00° 00'	4	01° 05'	25° 57'	4
5	04° 04'	00° 00'	5	04° 04'	00° 00'	5	01° 06'	31° 55'	5
6	05° 03'	00° 00'	6	05° 03'	00° 00'	6	01° 07'	38° 35'	6
7	06° 01'	01° 10'	7	06° 01'	01° 10'	7	01° 08'	44° 35'	7
8	07° 00'	01° 14'	8	07° 00'	01° 14'	8	01° 09'	51° 14'	8
9	08° 00'	01° 14'	9	08° 00'	01° 14'	9	01° 10'	57° 53'	9
10	09° 00'	01° 14'	10	09° 00'	01° 14'	10	01° 11'	63° 52'	10
11	10° 00'	01° 14'	11	10° 00'	01° 14'	11	01° 12'	70° 31'	11
12	11° 00'	01° 14'	12	11° 00'	01° 14'	12	01° 13'	76° 31'	12
13	12° 00'	01° 14'	13	12° 00'	01° 14'	13	01° 14'	83° 10'	13
14	13° 00'	01° 14'	14	13° 00'	01° 14'	14	01° 15'	89° 40'	14
15	14° 00'	01° 14'	15	14° 00'	01° 14'	15	01° 16'	95° 58'	15
16	15° 00'	01° 14'	16	15° 00'	01° 14'	16	01° 17'	102° 20'	16
17	16° 00'	01° 14'	17	16° 00'	01° 14'	17	01° 18'	108° 57'	17
18	17° 00'	01° 14'	18	17° 00'	01° 14'	18	01° 19'	115° 06'	18
19	18° 00'	01° 14'	19	18° 00'	01° 14'	19	01° 20'	121° 41'	19
20	19° 00'	01° 14'	20	19° 00'	01° 14'	20	01° 21'	127° 55'	20
21	20° 00'	01° 14'	21	20° 00'	01° 14'	21	01° 22'	134° 24'	21
22	21° 00'	01° 14'	22	21° 00'	01° 14'	22	01° 23'	140° 03'	22
23	22° 00'	01° 14'	23	22° 00'	01° 14'	23	01° 24'	147° 02'	23
24	23° 00'	01° 14'	24	23° 00'	01° 14'	24	01° 25'	153° 31'	24
25	24° 00'	01° 14'	25	24° 00'	01° 14'	25	01° 26'	159° 50'	25
26	25° 00'	01° 14'	26	25° 00'	01° 14'	26	01° 27'	166° 20'	26
27	26° 00'	01° 14'	27	26° 00'	01° 14'	27	01° 28'	172° 59'	27
28	27° 00'	01° 14'	28	27° 00'	01° 14'	28	01° 29'	178° 58'	28
29	28° 00'	01° 14'	29	28° 00'	01° 14'	29	01° 30'	185° 13'	29
30	29° 00'	01° 14'	30	29° 00'	01° 14'	30	01° 31'	191° 17'	30
31	30° 00'	01° 14'	31	30° 00'	01° 14'	31	01° 32'	198° 16'	31
32	31° 00'	01° 14'	32	31° 00'	01° 14'	32	01° 33'	204° 55'	32
33	32° 00'	01° 14'	33	32° 00'	01° 14'	33	01° 34'	210° 55'	33
34	33° 00'	01° 14'	34	33° 00'	01° 14'	34	01° 35'	217° 25'	34
35	34° 00'	01° 14'	35	34° 00'	01° 14'	35	01° 36'	223° 73'	35
36	35° 00'	01° 14'	36	35° 00'	01° 14'	36	01° 37'	230° 12'	36
37	36° 00'	01° 14'	37	36° 00'	01° 14'	37	01° 38'	236° 51'	37
38	37° 00'	01° 14'	38	37° 00'	01° 14'	38	01° 39'	242° 50'	38
39	38° 00'	01° 14'	39	38° 00'	01° 14'	39	01° 40'	249° 30'	39
40	39° 00'	01° 14'	40	39° 00'	01° 14'	40	01° 41'	255° 69'	40
41	40° 00'	01° 14'	41	40° 00'	01° 14'	41	01° 42'	262° 08'	41
42	41° 00'	01° 14'	42	41° 00'	01° 14'	42	01° 43'	268° 47'	42
43	42° 00'	01° 14'	43	42° 00'	01° 14'	43	01° 44'	274° 87'	43
44	43° 00'	01° 14'	44	43° 00'	01° 14'	44	01° 45'	281° 26'	44
45	44° 00'	01° 14'	45	44° 00'	01° 14'	45	01° 46'	287° 65'	45
46	45° 00'	01° 14'	46	45° 00'	01° 14'	46	01° 47'	294° 05'	46
47	46° 00'	01° 14'	47	46° 00'	01° 14'	47	01° 48'	300° 44'	47
48	47° 00'	01° 14'	48	47° 00'	01° 14'	48	01° 49'	305° 83'	48
49	48° 00'	01° 14'	49	48° 00'	01° 14'	49	01° 50'	313° 22'	49
50	49° 00'	01° 14'	50	49° 00'	01° 14'	50	01° 51'	319° 61'	50

Numbers	Sines Degrees		Tangents Degrees		Secants Degrees.		Numbers
	9	81			9	81	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
51	50 38	07 58	08 08	322 00	51 64	325 00	51
52	51 34	08 04	08 24	323 31	52 05	332 40	52
53	52 35	08 30	08 40	334 46	53 05	338 79	53
54	53 34	08 45	08 56	340 34	54 07	345 18	54
55	54 33	08 61	08 71	347 25	55 09	351 57	55
56	55 31	08 76	08 87	353 57	56 70	357 97	56
57	56 30	08 92	09 03	359 08	57 71	364 03	57
58	57 29	09 03	09 19	366 20	58 72	370 75	58
59	58 28	09 23	09 35	372 51	59 74	377 15	59
60	59 27	09 39	09 50	378 82	60 75	383 54	60
61	60 25	09 55	09 66	385 14	61 76	389 93	61
62	61 24	09 70	09 82	391 45	62 77	395 32	62
63	62 23	09 86	09 98	397 77	63 79	402 71	63
64	63 21	10 02	10 14	404 08	64 80	409 10	64
65	64 20	10 17	10 29	410 39	65 81	415 50	65
66	65 19	10 33	10 45	416 71	66 82	421 89	66
67	66 18	10 49	10 61	423 02	67 83	427 28	67
68	67 16	10 65	10 77	429 33	68 85	434 36	68
69	68 15	10 80	10 93	435 55	69 86	441 35	69
70	69 14	10 95	11 09	441 95	70 87	447 47	70
71	70 13	11 11	11 25	448 28	71 88	453 85	71
72	71 11	11 26	11 41	454 59	72 90	460 25	72
73	72 10	11 42	11 57	460 90	73 91	466 65	73
74	73 09	11 58	12 11	467 21	74 92	473 04	74
75	74 08	12 13	12 28	473 53	75 94	479 43	75
76	75 06	12 29	12 44	479 85	76 95	485 82	76
77	76 05	12 45	12 60	485 16	77 96	492 21	77
78	77 04	12 61	12 76	492 47	78 97	498 61	78
79	78 03	12 76	12 92	498 79	79 99	505 00	79
80	79 01	12 91	13 07	505 10	80 00	511 49	80
81	80 00	13 07	13 23	511 41	81 01	517 78	81
82	81 00	13 23	13 39	517 72	82 03	524 19	82
83	82 00	13 39	13 55	524 04	83 04	530 58	83
84	83 00	13 55	14 11	530 35	84 05	536 97	84
85	84 00	14 11	14 27	536 67	85 06	543 35	85
86	85 00	14 27	14 43	542 58	86 07	549 76	86
87	86 00	14 43	14 59	549 29	87 08	556 15	87
88	87 00	15 00	15 16	555 51	88 10	562 54	88
89	88 00	15 16	15 32	561 22	89 11	569 33	89
90	89 00	15 32	15 48	567 24	90 12	575 32	90
91	90 00	15 48	16 04	574 55	91 14	581 71	91
92	91 00	16 04	16 20	580 86	92 15	588 11	92
93	92 00	16 20	16 36	587 18	93 16	594 50	93
94	93 00	16 36	16 52	593 49	94 17	600 29	94
95	94 00	16 52	17 08	599 80	95 19	607 28	95
96	95 00	17 08	17 24	606 11	96 20	613 68	96
97	96 00	17 24	17 40	612 43	97 21	620 07	97
98	97 00	17 40	17 56	618 75	98 22	626 45	98
99	98 00	17 56	18 12	625 06	99 24	632 84	99
100	99 00	18 12	18 28	631 37	100 25	639 25	100

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	10	80		10	80		10	80	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 00	00 00	1	00 00	00 00	1	00 00	00 00	1
2	01 00	00 01	2	00 01	00 01	2	01 00	00 01	2
3	02 00	00 02	3	00 02	00 02	3	02 00	00 02	3
4	03 00	00 03	4	00 03	00 03	4	03 00	00 03	4
5	04 00	00 04	5	00 04	00 04	5	04 00	00 04	5
6	05 00	00 05	6	00 05	00 05	6	05 00	00 05	6
7	06 00	00 06	7	00 06	00 06	7	06 00	00 06	7
8	07 00	00 07	8	00 07	00 07	8	07 00	00 07	8
9	08 00	00 08	9	00 08	00 08	9	08 00	00 08	9
10	09 00	00 09	10	00 09	00 09	10	09 00	00 09	10
11	10 00	00 10	11	00 10	00 10	11	10 00	00 10	11
12	11 00	00 11	12	00 11	00 11	12	11 00	00 11	12
13	12 00	00 12	13	00 12	00 12	13	12 00	00 12	13
14	13 00	00 13	14	00 13	00 13	14	13 00	00 13	14
15	14 00	00 14	15	00 14	00 14	15	14 00	00 14	15
16	15 00	00 15	16	00 15	00 15	16	15 00	00 15	16
17	16 00	00 16	17	00 16	00 16	17	16 00	00 16	17
18	17 00	00 17	18	00 17	00 17	18	17 00	00 17	18
19	18 00	00 18	19	00 18	00 18	19	18 00	00 18	19
20	19 00	00 19	20	00 19	00 19	20	19 00	00 19	20
21	20 00	00 20	21	00 20	00 20	21	20 00	00 20	21
22	21 00	00 21	22	00 21	00 21	22	21 00	00 21	22
23	22 00	00 22	23	00 22	00 22	23	22 00	00 22	23
24	23 00	00 23	24	00 23	00 23	24	23 00	00 23	24
25	24 00	00 24	25	00 24	00 24	25	24 00	00 24	25
26	25 00	00 25	26	00 25	00 25	26	25 00	00 25	26
27	26 00	00 26	27	00 26	00 26	27	26 00	00 26	27
28	27 00	00 27	28	00 27	00 27	28	27 00	00 27	28
29	28 00	00 28	29	00 28	00 28	29	28 00	00 28	29
30	29 00	00 29	30	00 29	00 29	30	29 00	00 29	30
31	30 00	00 30	31	00 30	00 30	31	30 00	00 30	31
32	31 00	00 31	32	00 31	00 31	32	31 00	00 31	32
33	32 00	00 32	33	00 32	00 32	33	32 00	00 32	33
34	33 00	00 33	34	00 33	00 33	34	33 00	00 33	34
35	34 00	00 34	35	00 34	00 34	35	34 00	00 34	35
36	35 00	00 35	36	00 35	00 35	36	35 00	00 35	36
37	36 00	00 36	37	00 36	00 36	37	36 00	00 36	37
38	37 00	00 37	38	00 37	00 37	38	37 00	00 37	38
39	38 00	00 38	39	00 38	00 38	39	38 00	00 38	39
40	39 00	00 39	40	00 39	00 39	40	39 00	00 39	40
41	40 00	00 40	41	00 40	00 40	41	40 00	00 40	41
42	41 00	00 41	42	00 41	00 41	42	41 00	00 41	42
43	42 00	00 42	43	00 42	00 42	43	42 00	00 42	43
44	43 00	00 43	44	00 43	00 43	44	43 00	00 43	44
45	44 00	00 44	45	00 44	00 44	45	44 00	00 44	45
46	45 00	00 45	46	00 45	00 45	46	45 00	00 45	46
47	46 00	00 46	47	00 46	00 46	47	46 00	00 46	47
48	47 00	00 47	48	00 47	00 47	48	47 00	00 47	48
49	48 00	00 48	49	00 48	00 48	49	48 00	00 48	49
50	49 00	00 49	50	00 49	00 49	50	49 00	00 49	50



Numbers	Sines Degrees			Tangents Degrees			Secants. Degrees.		Numbers
	10	80		10	80		10	80	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	50 23	08 85		09 00	289 24		51 78	293 70	51
52	51 21	09 02		09 018	294 31		52 08	299 45	52
53	52 20	09 19		09 035	300 58		53 08	305 21	53
54	53 18	09 37		09 053	306 26		54 08	310 39	54
55	54 17	09 55		09 071	311 94		55 08	316 73	55
56	55 15	09 72		09 089	317 60		56 08	322 49	56
57	56 14	09 89		10 006	323 27		57 08	328 24	57
58	57 12	10 07		10 024	328 94		58 08	333 00	58
59	58 11	10 24		10 041	334 31		59 08	339 26	59
60	59 09	10 42		10 058	340 28		60 08	345 53	60
61	60 08	10 59		10 076	345 95		61 08	351 29	61
62	61 07	10 77		10 094	351 03		62 08	357 05	62
63	62 05	10 94		11 011	357 30		63 08	362 31	63
64	63 04	11 12		11 029	362 97		64 08	368 06	64
65	64 02	11 29		11 047	368 64		65 08	374 32	65
66	65 01	11 46		11 064	374 31		66 08	380 08	66
67	65 99	11 64		11 082	379 08		67 08	385 84	67
68	66 98	11 81		12 000	385 06		68 08	391 60	68
69	66 96	11 98		12 017	391 33		69 08	397 35	69
70	68 94	12 16		12 034	396 99		70 08	403 12	70
71	69 93	12 33		12 053	402 66		71 08	408 87	71
72	70 91	12 51		12 071	408 33		72 08	414 63	72
73	71 89	12 68		12 089	414 00		73 08	420 39	73
74	72 88	12 85		13 006	419 67		74 08	426 15	74
75	73 86	13 02		13 024	425 34		75 08	431 91	75
76	74 85	13 20		13 041	431 01		76 08	437 67	76
77	75 83	13 37		13 059	436 68		77 08	443 43	77
78	76 82	13 54		13 076	442 36		78 08	449 19	78
79	77 80	13 72		13 094	448 03		79 08	454 94	79
80	78 78	13 89		14 011	451 70		80 08	460 70	80
81	79 77	14 06		14 029	459 37		81 08	466 46	81
82	80 76	14 24		14 047	465 04		82 08	472 22	82
83	81 74	14 41		14 064	470 71		83 08	477 98	83
84	82 73	14 58		14 082	476 38		84 08	483 74	84
85	83 71	14 76		15 000	482 06		85 08	489 50	85
86	84 70	14 93		15 018	487 73		86 08	495 25	86
87	85 68	15 11		15 035	493 40		87 08	500 01	87
88	86 67	15 28		15 053	499 07		88 08	505 77	88
89	87 65	15 45		15 071	504 74		89 08	511 53	89
90	88 63	15 63		15 087	510 42		90 08	518 29	90
91	89 61	15 80		16 005	516 08		91 08	523 05	91
92	90 60	15 97		16 023	521 75		92 08	529 81	92
93	91 58	16 14		16 041	527 43		93 08	535 56	93
94	92 57	16 32		16 059	533 10		94 08	541 32	94
95	93 55	16 49		16 076	538 77		95 08	547 08	95
96	94 54	16 67		16 094	544 44		96 08	552 84	96
97	95 52	16 85		17 011	550 11		97 08	558 60	97
98	96 51	17 02		17 029	555 78		98 08	564 36	98
99	97 49	17 19		17 046	561 46		99 08	570 11	99
100	98 48	17 36		17 063	567 13		100 08	575 88	100



7 Rhumb is 78 deg. 45 min.

1 Rhumb is 11 deg. 15 min.

Numbers.	Sines Degrees		Numbers.	Tangents Degrees		Numbers.	Secants Degrees		Numbers.	
	11	79		11	79		11	79		
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.		
1	00	00	1	00	05	1	01	02	1	05
2	01	00	2	00	10	2	02	04	2	06
3	02	01	3	00	15	3	03	06	3	07
4	03	02	4	00	20	4	04	07	4	08
5	04	03	5	00	25	5	05	09	5	09
6	05	04	6	01	30	6	06	11	6	11
7	06	05	7	01	35	7	07	13	7	12
8	07	06	8	01	40	8	08	15	8	13
9	08	07	9	01	45	9	09	17	9	14
10	09	08	10	01	50	10	10	19	10	15
11	10	09	11	02	55	11	11	21	11	16
12	11	10	12	02	00	12	12	22	12	17
13	12	11	13	02	05	13	13	24	13	18
14	13	12	14	02	10	14	14	26	14	19
15	14	13	15	02	15	15	15	28	15	20
16	15	14	16	03	20	16	16	30	16	21
17	16	15	17	03	25	17	17	32	17	22
18	17	16	18	03	30	18	18	34	18	23
19	18	17	19	03	35	19	19	36	19	24
20	19	18	20	03	40	20	20	37	20	25
21	20	19	21	04	45	21	21	39	21	26
22	21	20	22	04	50	22	22	41	22	27
23	22	21	23	04	55	23	23	43	23	28
24	23	22	24	04	00	24	24	45	24	29
25	24	23	25	04	05	25	25	47	25	30
26	25	24	26	05	10	26	26	49	26	31
27	26	25	27	05	15	27	27	51	27	32
28	27	26	28	05	20	28	28	52	28	33
29	28	27	29	05	25	29	29	54	29	34
30	29	28	30	05	30	30	30	56	30	35
31	30	29	31	06	35	31	31	58	31	36
32	31	30	32	06	40	32	32	60	32	37
33	32	31	33	06	45	33	33	62	33	38
34	33	32	34	06	50	34	34	64	34	39
35	34	33	35	06	55	35	35	66	35	40
36	35	34	36	07	00	36	36	67	36	41
37	36	35	37	07	05	37	37	69	37	42
38	37	36	38	07	10	38	38	71	38	43
39	38	37	39	07	15	39	39	73	39	44
40	39	38	40	07	20	40	40	75	40	45
41	40	39	41	07	25	41	41	77	41	46
42	41	40	42	08	30	42	42	79	42	47
43	42	41	43	08	35	43	43	81	43	48
44	43	42	44	08	40	44	44	83	44	49
45	44	43	45	08	45	45	45	84	45	50
46	45	44	46	08	50	46	46	86	46	51
47	46	45	47	09	05	47	47	88	47	52
48	47	46	48	09	10	48	48	90	48	53
49	48	47	49	09	15	49	49	92	49	54
50	49	48	50	09	20	50	50	94	50	55

1 Rhumb is 11 deg. 15 min.

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	11	79		11	79		11	79	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	50 06	09 74		09 92	262 37		51 56	267 28	51
52	51 04	09 09		10 11	267 51		52 08	272 52	52
53	52 03	10 12		10 31	272 54		53 00	277 56	53
54	53 01	10 31		10 50	277 58		54 02	283 00	54
55	54 00	10 50		10 70	282 94		55 03	288 21	55
56	54 98	10 69		10 89	288 09		56 05	293 48	56
57	55 06	10 88		11 09	293 23		57 07	298 72	57
58	56 04	10 07		11 28	298 48		58 09	303 96	58
59	57 02	11 26		11 47	303 52		59 11	309 20	59
60	58 00	11 45		11 66	308 67		60 12	314 45	60
61	59 08	11 65		11 86	313 81		61 14	319 69	61
62	60 06	11 84		12 05	318 96		62 16	324 93	62
63	61 04	12 03		12 25	324 10		63 18	330 17	63
64	62 02	12 22		12 44	329 25		64 20	335 41	64
65	63 00	12 41		12 64	334 40		65 22	340 65	65
66	64 00	12 60		12 83	339 54		66 24	345 89	66
67	65 00	12 79		13 03	344 69		67 26	351 13	67
68	66 00	12 98		13 22	349 83		68 28	356 37	68
69	67 00	13 17		13 42	354 98		69 30	361 56	69
70	68 00	13 36		13 61	360 12		70 31	366 86	70
71	69 00	13 55		13 81	365 25		71 33	372 10	71
72	70 00	14 14		14 02	370 40		72 35	377 34	72
73	71 00	14 33		14 20	375 54		73 37	382 58	73
74	72 00	14 52		14 39	380 69		74 39	387 82	74
75	73 00	15 11		14 59	385 83		75 41	393 06	75
76	74 00	15 30		15 18	390 98		76 43	398 30	76
77	75 00	15 49		15 38	396 12		77 45	403 54	77
78	76 00	16 08		15 57	401 27		78 47	409 18	78
79	77 00	16 27		16 17	406 42		79 49	414 42	79
80	78 00	16 46		16 36	411 56		80 51	419 66	80
81	79 00	17 05		16 55	416 71		81 53	424 90	81
82	80 00	17 24		17 14	421 85		82 55	429 14	82
83	81 00	17 43		17 33	426 99		83 57	434 38	83
84	82 00	18 02		17 52	432 14		84 59	439 62	84
85	83 00	18 21		18 11	437 29		85 61	444 86	85
86	84 00	18 40		18 30	442 43		86 63	450 10	86
87	85 00	19 00		18 49	447 58		87 65	455 34	87
88	86 00	19 19		19 08	452 72		88 67	460 58	88
89	87 00	19 38		19 27	457 87		89 69	466 12	89
90	88 00	19 57		19 46	463 01		90 71	471 36	90
91	89 00	20 16		19 65	468 15		91 73	476 60	91
92	90 00	20 35		19 84	473 29		92 75	481 84	92
93	91 00	20 54		19 03	478 44		93 77	487 08	93
94	92 00	21 13		19 22	483 58		94 79	492 32	94
95	93 00	21 32		19 41	488 73		95 81	497 56	95
96	94 00	21 51		19 60	493 87		96 83	503 10	96
97	95 00	22 10		19 79	499 02		97 85	508 34	97
98	96 00	22 29		19 98	504 16		98 87	513 58	98
99	97 00	22 48		20 17	509 31		99 89	519 12	99
100	98 00	23 07		20 36	514 45		100 91	524 36	100

7 Rhumb is 78 deg. 45 min.

Numbers.	Sines Degrees		Numbers.	Tangents Degrees		Numbers.	Secants Degrees		Numbers.
	12	82		12	82		12	82	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 00	00 21	1	00 00	04 70	1	00 02	04 81	1
2	01 01	00 42	2	00 01	09 41	2	00 04	09 82	2
3	02 03	00 62	3	00 02	14 11	3	00 07	14 43	3
4	03 05	00 83	4	00 03	18 52	4	00 09	19 24	4
5	04 08	01 04	5	01 06	23 52	5	01 11	24 05	5
6	05 08	01 25	6	01 28	28 23	6	01 13	28 86	6
7	06 08	01 46	7	01 49	32 53	7	01 16	33 67	7
8	07 09	01 66	8	01 50	37 24	8	01 18	34 47	8
9	08 10	01 87	9	01 51	42 34	9	01 20	43 28	9
10	09 11	02 08	10	02 13	47 05	10	01 22	48 09	10
11	10 12	02 29	11	02 34	51 75	11	01 24	52 90	11
12	11 13	02 50	12	02 55	56 46	12	01 27	57 17	12
13	12 14	03 11	13	03 00	61 16	13	01 29	62 52	13
14	13 15	03 32	14	03 08	65 57	14	01 31	67 33	14
15	14 16	03 53	15	03 19	70 57	15	01 34	72 14	15
16	15 17	04 14	16	03 40	75 27	16	01 36	76 95	16
17	16 18	04 35	17	03 46	79 58	17	01 38	81 76	17
18	17 19	04 56	18	03 53	84 28	18	01 40	85 57	18
19	18 20	05 17	19	04 01	89 39	19	01 42	91 38	19
20	19 21	05 38	20	04 25	94 09	20	01 45	96 19	20
21	20 22	05 59	21	04 46	98 79	21	01 47	101 00	21
22	21 23	06 20	22	04 58	103 50	22	01 50	105 81	22
23	22 24	06 41	23	05 10	108 12	23	01 52	110 62	23
24	23 25	07 02	24	05 21	112 10	24	01 54	115 43	24
25	24 26	07 23	25	05 31	117 61	25	01 56	120 24	25
26	25 27	07 44	26	05 53	122 32	26	01 58	125 05	26
27	26 28	08 05	27	06 04	127 02	27	02 00	129 86	27
28	27 29	08 26	28	06 16	131 73	28	02 03	134 67	28
29	28 30	08 47	29	06 38	136 21	29	02 05	139 48	29
30	29 31	09 08	30	06 59	141 14	30	02 07	144 28	30
31	30 32	09 29	31	07 21	145 51	31	02 10	149 09	31
32	31 33	09 50	32	07 42	150 22	32	02 12	153 23	32
33	32 34	10 11	33	08 01	155 25	33	02 14	158 23	33
34	33 35	10 32	34	08 23	159 56	34	02 16	163 52	34
35	34 36	10 53	35	08 44	164 06	35	02 18	168 33	35
36	35 37	11 14	36	09 05	169 37	36	02 20	173 14	36
37	36 38	11 35	37	09 26	174 07	37	02 23	177 95	37
38	37 39	11 56	38	09 47	178 52	38	02 25	182 76	38
39	38 40	12 17	39	09 68	183 48	39	02 27	187 57	39
40	39 41	12 38	40	10 00	188 19	40	02 29	192 37	40
41	40 42	12 59	41	10 21	192 89	41	02 31	197 18	41
42	41 43	13 20	42	10 42	197 60	42	02 33	201 99	42
43	42 44	13 41	43	11 03	202 30	43	02 35	206 80	43
44	43 45	14 02	44	11 24	207 01	44	02 37	211 61	44
45	44 46	14 23	45	11 45	211 71	45	02 39	216 42	45
46	45 47	14 44	46	12 06	216 42	46	02 41	221 23	46
47	46 48	15 05	47	12 27	221 12	47	02 43	226 04	47
48	47 49	15 26	48	12 48	225 58	48	02 45	230 71	48
49	48 50	15 47	49	13 09	230 53	49	02 47	235 56	49
50	49 51	16 08	50	13 30	235 23	50	02 49	240 47	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	12	78		12	78		12	78	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	49 89	10 60		10 84	239 94		52 14	245 28	51
52	50 87	10 81		11 05	244 64		53 16	250 09	52
53	51 01	11 02		11 26	249 35		54 18	254 36	53
54	52 03	11 23		11 48	254 05		55 20	259 27	54
55	53 00	11 44		11 69	259 76		56 23	264 52	55
56	54 78	11 64		11 90	263 46		57 25	269 33	56
57	55 76	11 85		12 11	268 17		58 28	274 14	57
58	56 73	12 06		12 33	272 52		59 30	278 59	58
59	57 71	12 26		12 54	277 35		60 32	283 75	59
60	58 69	12 47		12 75	282 28		61 34	288 56	60
61	59 67	12 67		12 96	286 68		62 36	293 37	61
62	60 65	12 88		13 18	291 69		63 38	298 18	62
63	61 63	13 09		13 39	296 39		64 40	302 99	63
64	62 60	13 30		13 60	301 10		65 42	307 40	64
65	63 58	13 51		13 81	305 80		66 45	312 01	65
66	64 56	13 71		14 03	310 50		67 47	317 42	66
67	65 53	13 92		14 24	315 21		68 50	322 23	67
68	66 51	14 13		14 45	319 91		69 52	327 04	68
69	67 49	14 34		14 66	324 62		70 54	331 84	69
70	68 47	14 55		14 88	329 32		71 56	336 66	70
71	69 45	14 76		15 09	334 03		72 58	341 47	71
72	70 43	14 97		15 30	338 73		73 60	346 28	72
73	71 40	15 18		15 51	343 44		74 63	351 09	73
74	72 38	15 39		15 73	348 14		75 65	355 50	74
75	73 36	15 60		15 94	352 85		76 67	360 71	75
76	74 34	15 81		16 15	357 55		77 70	365 52	76
77	75 31	16 01		16 36	362 26		78 72	370 32	77
78	76 29	16 22		16 58	367 06		79 74	375 13	78
79	77 27	16 43		16 79	371 46		80 76	379 54	79
80	78 25	16 63		17 00	376 37		81 78	384 75	80
81	79 23	16 84		17 21	381 08		82 80	389 56	81
82	80 20	17 05		17 43	385 78		83 83	394 37	82
83	81 18	17 25		17 64	390 49		84 85	399 18	83
84	82 16	17 46		17 85	395 20		85 87	403 99	84
85	83 14	17 67		18 06	399 50		86 89	408 80	85
86	84 12	17 88		18 28	404 60		87 91	413 61	86
87	85 10	18 09		18 49	409 31		88 93	418 42	87
88	86 08	18 30		18 70	414 01		89 95	423 23	88
89	87 06	18 50		18 92	418 72		90 98	428 04	89
90	88 03	18 71		19 13	423 42		91 01	432 84	90
91	89 01	18 92		19 34	428 13		92 03	437 65	91
92	90 00	19 13		19 55	432 84		93 05	442 46	92
93	91 00	19 33		19 76	437 54		94 07	447 27	93
94	92 00	19 54		19 98	442 24		95 09	452 08	94
95	93 00	19 75		20 19	447 05		96 12	456 89	95
96	94 00	19 96		20 40	451 65		97 14	461 70	96
97	95 00	20 17		20 61	456 35		98 16	466 51	97
98	96 00	20 37		20 83	461 06		99 18	471 32	98
99	97 00	20 58		21 04	465 76		100 20	476 13	99
100	98 01	20 79		21 25	470 46		102 23	480 94	100

Numbers.	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	13	77		13	77		13	77	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00	00	difference	00	00	difference	01	02	01
2	01	01	00	01	01	00	02	03	02
3	02	02	00	02	02	00	03	04	03
4	03	03	00	03	03	00	04	05	04
5	04	04	01	04	04	01	05	06	05
6	05	05	01	05	05	01	06	07	06
7	06	06	01	06	06	01	07	08	07
8	07	07	01	07	07	01	08	09	08
9	08	08	02	08	08	02	09	10	09
10	09	09	02	09	09	02	10	11	10
11	10	10	02	10	10	02	11	12	11
12	11	11	02	11	11	02	12	13	12
13	12	12	02	12	12	02	13	14	13
14	13	13	02	13	13	02	14	15	14
15	14	14	03	14	14	03	15	16	15
16	15	15	03	15	15	03	16	17	16
17	16	16	03	16	16	03	17	18	17
18	17	17	04	17	17	04	18	19	18
19	18	18	04	18	18	04	19	20	19
20	19	19	04	19	19	04	20	21	20
21	20	20	04	20	20	04	21	22	21
22	21	21	04	21	21	04	22	23	22
23	22	22	05	22	22	05	23	24	23
24	23	23	05	23	23	05	24	25	24
25	24	24	05	24	24	05	25	26	25
26	25	25	05	25	25	05	26	27	26
27	26	26	06	26	26	06	27	28	27
28	27	27	06	27	27	06	28	29	28
29	28	28	06	28	28	06	29	30	29
30	29	29	06	29	29	06	30	31	30
31	30	30	06	30	30	06	31	32	31
32	31	31	07	31	31	07	32	33	32
33	32	32	07	32	32	07	33	34	33
34	33	33	07	33	33	07	34	35	34
35	34	34	07	34	34	07	35	36	35
36	35	35	08	35	35	08	36	37	36
37	36	36	08	36	36	08	37	38	37
38	37	37	08	37	37	08	38	39	38
39	38	38	08	38	38	08	39	40	39
40	38	38	09	39	39	09	40	41	40
41	39	39	09	40	40	09	41	42	41
42	40	40	09	41	41	09	42	43	42
43	41	41	09	42	42	09	43	44	43
44	42	42	09	43	43	09	44	45	44
45	43	43	10	44	44	10	45	46	45
46	44	44	10	45	45	10	46	47	46
47	45	45	10	46	46	10	47	48	47
48	46	46	10	47	47	10	48	49	48
49	47	47	11	48	48	11	49	50	49
50	48	48	11	49	49	11	50	51	50



Numbers	Sines Degrees			Tangents Degrees			Secants Degrees.		Numbers
	1	77		13	77		13	77	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	49 69	11 47		11 77	220 90		52 34	226 71	51
52	50 66	11 07		12 00	225 23		53 03	231 15	52
53	51 64	11 02		12 23	229 56		54 39	235 59	53
54	52 61	12 15		12 46	233 10		55 42	240 04	54
55	53 58	12 37		12 69	238 23		56 45	244 48	55
56	54 55	12 60		12 92	242 56		57 47	248 93	56
57	55 52	12 82		13 15	246 64		58 50	253 36	57
58	56 50	13 05		13 39	251 23		59 53	257 32	58
59	57 48	13 27		13 62	255 12		60 55	262 26	59
60	58 46	13 50		13 85	259 89		61 58	266 72	60
61	59 43	13 72		14 08	264 22		62 60	271 16	61
62	60 40	13 95		14 31	268 55		63 63	275 61	62
63	61 38	14 07		14 54	272 88		64 66	280 05	63
64	62 35	14 40		14 77	277 21		65 68	284 50	64
65	63 33	14 62		15 00	281 54		66 71	289 94	65
66	64 30	14 85		15 23	285 87		67 74	293 39	66
67	65 28	15 07		15 47	290 20		68 76	297 83	67
68	66 25	15 30		15 70	294 33		69 79	302 28	68
69	67 23	15 52		15 93	298 85		70 81	306 73	69
70	68 20	15 75		16 16	303 20		71 84	311 18	70
71	69 17	15 97		16 39	307 53		72 86	315 62	71
72	70 15	16 20		16 62	311 24		73 89	320 07	72
73	71 12	16 42		16 85	316 20		74 92	324 52	73
74	72 10	16 65		17 08	320 53		75 95	328 96	74
75	73 07	16 87		17 31	324 85		76 97	333 40	75
76	74 05	17 10		17 54	329 20		77 00	337 85	76
77	75 02	17 32		17 77	333 05		78 02	342 29	77
78	76 00	17 55		18 00	337 85		79 05	346 74	78
79	76 97	17 77		18 23	342 19		80 08	351 18	79
80	77 95	18 00		18 47	346 52		81 10	355 63	80
81	78 92	18 22		18 69	350 84		82 13	360 07	81
82	79 90	18 45		18 92	355 18		83 16	364 52	82
83	80 87	18 67		19 15	359 51		84 18	368 96	83
84	81 85	18 90		19 39	363 84		85 21	373 40	84
85	82 82	19 12		19 62	368 17		86 24	377 85	85
86	83 80	19 35		19 85	372 50		87 26	382 29	86
87	84 77	19 57		20 08	376 83		88 29	386 74	87
88	85 75	19 80		20 31	381 16		89 31	391 19	88
89	86 72	20 02		20 54	385 50		90 34	395 64	89
90	87 69	20 25		20 78	389 83		91 37	400 09	90
91	88 67	20 47		21 00	394 16		92 39	404 54	91
92	89 65	20 70		21 23	398 50		93 42	408 98	92
93	90 62	20 92		21 47	402 83		94 45	413 43	93
94	91 60	21 15		21 70	407 16		95 47	417 87	94
95	92 57	21 37		21 93	411 50		96 50	422 32	95
96	93 55	21 60		22 16	415 83		97 53	426 76	96
97	94 52	21 80		22 40	420 16		98 55	431 20	97
98	95 50	22 05		22 63	424 50		99 58	435 65	98
99	96 47	22 27		22 86	429 32		100 60	440 09	99
100	97 44	22 50		23 09	433 15		102 63	444 54	100



6 Rhumb and three quarters is 75 deg. 56 min.

Numbers	Secants Degrees	
	14	76
	N. pts.	N. pts.
1	01 03	01 13
2	01 05	01 26
3	01 09	01 40
4	01 12	01 53
5	01 15	02 07
6	01 18	02 21
7	01 21	02 34
8	01 24	02 48
9	01 27	02 53
10	01 31	03 07
11	01 34	03 20
12	01 37	03 33
13	01 40	03 46
14	01 43	03 59
15	01 46	04 12
16	01 49	04 25
17	01 52	04 38
18	01 55	04 51
19	01 58	05 04
20	02 01	05 17
21	02 04	05 30
22	02 07	05 43
23	02 10	05 56
24	02 13	06 09
25	02 16	06 22
26	02 19	06 35
27	02 22	06 48
28	02 25	07 01
29	02 28	07 14
30	02 31	07 27
31	02 34	07 40
32	02 37	07 53
33	02 40	08 06
34	02 43	08 19
35	02 46	08 32
36	02 49	08 45
37	02 52	08 58
38	02 55	09 11
39	02 58	09 24
40	03 01	09 37
41	03 04	09 50
42	03 07	10 03
43	03 10	10 16
44	03 13	10 29
45	03 16	10 42
46	03 19	10 55
47	03 22	11 08
48	03 25	11 21
49	03 28	11 34
50	03 31	11 47

Numbers	Tangents Degrees	
	14	76
	N. pts.	N. pts.
1	01 25	01 01
2	01 25	01 02
3	01 25	01 03
4	01 25	01 04
5	01 25	01 05
6	01 25	01 06
7	01 25	01 07
8	01 25	01 08
9	01 25	01 09
10	01 25	01 10
11	01 25	01 11
12	01 25	01 12
13	01 25	01 13
14	01 25	01 14
15	01 25	01 15
16	01 25	01 16
17	01 25	01 17
18	01 25	01 18
19	01 25	01 19
20	01 25	01 20
21	01 25	01 21
22	01 25	01 22
23	01 25	01 23
24	01 25	01 24
25	01 25	01 25
26	01 25	01 26
27	01 25	01 27
28	01 25	01 28
29	01 25	01 29
30	01 25	01 30
31	01 25	01 31
32	01 25	01 32
33	01 25	01 33
34	01 25	01 34
35	01 25	01 35
36	01 25	01 36
37	01 25	01 37
38	01 25	01 38
39	01 25	01 39
40	01 25	01 40
41	01 25	01 41
42	01 25	01 42
43	01 25	01 43
44	01 25	01 44
45	01 25	01 45
46	01 25	01 46
47	01 25	01 47
48	01 25	01 48
49	01 25	01 49
50	01 25	01 50

Numbers	Sines Degrees	
	14	76
	N. pts.	N. pts.
1	00 00	00 24
2	00 00	00 48
3	00 00	00 73
4	00 00	00 97
5	00 00	01 24
6	00 00	01 45
7	00 00	01 69
8	00 00	01 94
9	00 00	02 18
10	00 00	02 42
11	00 00	02 66
12	00 00	02 90
13	00 00	03 15
14	00 00	03 39
15	00 00	03 63
16	00 00	03 87
17	00 00	04 11
18	00 00	04 36
19	00 00	04 60
20	00 00	04 84
21	00 00	05 08
22	00 00	05 33
23	00 00	05 57
24	00 00	06 21
25	00 00	06 45
26	00 00	06 29
27	00 00	06 54
28	00 00	07 18
29	00 00	07 42
30	00 00	07 26
31	00 00	07 50
32	00 00	08 14
33	00 00	08 38
34	00 00	08 62
35	00 00	08 86
36	00 00	09 10
37	00 00	09 34
38	00 00	09 58
39	00 00	10 22
40	00 00	10 46
41	00 00	11 10
42	00 00	11 34
43	00 00	11 58
44	00 00	12 22
45	00 00	12 46
46	00 00	13 10
47	00 00	13 34
48	00 00	13 58
49	00 00	14 22
50	00 00	14 46

3 Rhumb and a quarter is 14 deg. 4 min.

1 Rhumb and a quarter is 14 deg. 4 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	14	76		14	76		14	76	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	49 49	12 31	51	12 71	204 55	51	52 56	210 83	51
52	50 45	12 03	52	12 56	208 56	52	53 09	214 94	52
53	51 43	12 03	53	13 21	212 05	53	54 23	219 07	53
54	52 40	13 07	54	13 46	216 58	54	55 65	223 20	54
55	53 37	13 31	55	13 71	220 59	55	56 68	227 34	55
56	54 34	13 55	56	13 95	224 60	56	57 71	231 47	56
57	55 31	13 07	57	14 21	228 61	57	58 74	235 50	57
58	56 28	14 04	58	14 46	232 62	58	59 77	239 74	58
59	57 25	14 28	59	14 71	236 63	59	60 79	243 81	59
60	58 22	14 52	60	14 96	240 65	60	61 84	248 01	60
61	59 19	14 76	61	15 21	244 66	61	62 87	252 15	61
62	60 16	15 00	62	15 46	248 67	62	63 90	256 28	62
63	61 13	15 24	63	15 71	252 68	63	64 93	260 41	63
64	62 10	15 48	64	15 96	256 69	64	65 96	264 55	64
65	63 07	15 73	65	16 21	260 70	65	66 99	268 68	65
66	64 04	15 97	66	16 46	264 71	66	68 02	272 81	66
67	65 01	16 21	67	16 70	268 72	67	69 05	276 95	67
68	65 98	16 45	68	16 95	272 73	68	70 08	281 08	68
69	66 95	16 69	69	17 20	276 74	69	71 11	285 21	69
70	67 92	16 93	70	17 45	280 75	70	72 14	289 35	70
71	68 89	17 17	71	17 70	284 76	71	73 17	293 48	71
72	69 86	17 41	72	17 95	288 77	72	74 20	297 61	72
73	70 83	17 05	73	18 20	292 78	73	75 23	301 75	73
74	71 80	17 29	74	18 45	296 79	74	76 26	305 88	74
75	72 77	18 14	75	18 70	300 81	75	77 30	310 01	75
76	73 74	18 38	76	18 95	304 82	76	78 33	314 15	76
77	74 71	18 62	77	19 20	308 83	77	79 36	318 28	77
78	75 68	18 86	78	19 45	312 84	78	80 39	322 41	78
79	76 65	19 10	79	19 70	316 85	79	81 42	326 55	79
80	77 62	19 35	80	19 95	320 86	80	82 45	330 69	80
81	78 60	19 39	81	20 20	324 87	81	83 48	334 82	81
82	79 57	19 64	82	20 45	328 88	82	84 51	338 95	82
83	80 54	20 08	83	20 70	332 89	83	85 54	343 09	83
84	81 51	20 32	84	20 95	336 90	84	86 57	347 22	84
85	82 48	20 56	85	21 19	340 92	85	87 60	351 35	85
86	83 45	20 80	86	21 44	344 93	86	88 63	355 48	86
87	84 42	21 05	87	21 69	348 94	87	89 66	359 62	87
88	85 39	21 29	88	21 94	352 95	88	90 69	363 75	88
89	86 36	21 53	89	22 19	356 96	89	91 72	367 89	89
90	87 33	21 77	90	22 44	360 97	90	92 75	372 02	90
91	88 30	22 01	91	22 69	364 98	91	93 78	376 15	91
92	89 27	22 25	92	22 94	368 99	92	94 81	380 29	92
93	90 24	22 49	93	23 19	373 00	93	95 84	384 42	93
94	91 21	22 74	94	23 44	377 01	94	96 87	388 56	94
95	92 18	22 98	95	23 68	381 02	95	97 91	392 69	95
96	93 15	23 23	96	23 93	385 03	96	98 94	396 83	96
97	94 12	23 46	97	24 18	389 04	97	99 97	400 96	97
98	95 09	23 70	98	24 43	393 06	98	101 00	405 09	98
99	96 06	23 94	99	24 68	397 07	99	102 03	409 23	99
100	97 03	24 19	100	24 93	401 08	100	103 06	413 36	100

6 Rhumb and three quarters is 75 deg. 56 min.

Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	15	75	15	75	15	75	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
1	00 97	00 25	00 27	03 73	01 04	03 86	1
2	01 93	00 52	00 54	07 46	02 07	07 73	2
3	02 90	00 58	00 80	11 20	03 11	11 56	3
4	03 86	01 04	01 07	14 53	04 14	15 45	4
5	04 83	01 29	01 34	18 66	05 18	19 32	5
6	05 80	01 55	01 61	22 39	06 21	23 18	6
7	06 76	02 08	01 08	25 12	07 25	27 05	7
8	07 73	02 07	02 14	29 06	08 28	30 91	8
9	08 70	02 33	02 41	33 59	09 32	34 77	9
10	09 66	02 59	02 63	37 32	10 35	38 64	10
11	10 63	02 85	02 95	41 05	11 39	42 50	11
12	11 60	03 11	03 02	44 78	12 42	46 37	12
13	12 56	03 37	03 48	48 42	13 46	50 23	13
14	13 53	03 63	03 75	52 25	14 49	54 09	14
15	14 50	04 08	04 02	55 98	15 53	57 96	15
16	15 46	04 14	04 29	59 71	16 56	61 82	16
17	16 43	04 40	04 54	63 44	17 06	65 69	17
18	17 40	04 66	04 82	67 16	18 06	69 55	18
19	18 36	04 92	05 00	70 91	19 07	73 41	19
20	19 32	05 18	05 36	74 64	20 71	77 28	20
21	20 28	05 44	05 63	78 37	21 74	81 15	21
22	21 23	05 70	05 90	82 10	22 77	85 00	22
23	22 22	06 06	06 16	85 78	23 81	88 86	23
24	23 08	06 22	06 43	89 57	24 84	92 73	24
25	24 15	06 47	06 70	93 30	25 88	96 59	25
26	25 12	06 73	06 97	97 03	26 92	100 45	26
27	26 08	06 99	07 04	100 76	27 95	104 32	27
28	27 05	07 25	07 50	104 50	28 98	108 18	28
29	28 02	07 51	07 77	108 723	29 02	112 05	29
30	28 98	07 76	08 04	111 96	30 06	115 91	30
31	29 95	08 02	08 31	115 69	31 10	119 77	31
32	30 92	08 28	08 46	119 42	32 13	123 64	32
33	31 88	08 54	08 84	123 14	33 17	127 50	33
34	32 85	08 80	09 11	126 89	34 20	131 37	34
35	33 82	09 05	09 38	130 62	35 24	135 23	35
36	34 78	09 31	09 65	134 35	36 27	139 09	36
37	35 75	09 57	09 92	138 08	37 31	142 54	37
38	36 72	09 53	10 18	141 82	38 34	146 39	38
39	37 63	10 09	10 45	145 55	39 38	150 26	39
40	38 64	10 35	10 72	149 28	40 41	154 11	40
41	39 60	10 61	10 99	153 01	41 45	157 96	41
42	40 57	10 87	11 26	156 74	42 48	161 82	42
43	41 54	11 13	11 52	160 48	43 52	165 67	43
44	42 50	11 49	11 79	164 21	44 55	169 52	44
45	43 46	11 65	12 06	167 94	45 59	173 38	45
46	44 43	11 91	12 33	171 67	46 62	177 23	46
47	45 40	12 17	12 58	175 40	47 66	181 09	47
48	46 36	12 43	13 08	179 12	48 70	184 55	48
49	47 33	12 69	13 13	182 87	49 73	188 41	49
50	48 30	12 94	13 40	185 60	50 76	192 26	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	15	75		15	75		15	75	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	49 26	13 20		13 67	190 33		52 80	197 05	51
52	50 23	13 04		13 94	194 06		53 08	200 01	52
53	51 19	13 02		14 00	197 79		54 07	204 77	53
54	52 16	13 08		14 47	201 15		55 09	208 64	54
55	53 13	14 24		14 72	205 26		56 04	212 50	55
56	54 09	14 50		15 00	208 99		57 07	216 37	56
57	55 06	14 07		15 12	212 72		58 05	220 23	57
58	56 03	15 02		15 54	216 45		59 01	224 09	58
59	56 99	15 28		15 80	220 17		60 09	227 51	59
60	57 56	15 54		16 08	223 92		61 12	231 82	60
61	58 93	16 80		16 34	227 65		62 16	235 69	61
62	59 89	16 06		16 61	231 38		63 19	239 55	62
63	60 83	16 32		16 88	235 11		64 23	243 41	63
64	61 80	16 58		17 14	238 21		65 26	247 28	64
65	62 77	16 83		17 41	242 53		66 30	251 15	65
66	63 74	17 09		17 68	246 31		67 33	255 00	66
67	64 71	17 36		17 95	250 04		68 37	258 86	67
68	65 68	17 61		18 22	253 77		69 40	262 73	68
69	66 64	17 87		18 48	257 51		70 44	266 59	69
70	67 61	18 12		18 76	261 24		71 47	270 46	70
71	68 57	18 32		19 02	264 97		72 51	274 32	71
72	69 54	18 64		19 29	268 70		73 54	278 18	72
73	70 51	18 89		19 54	272 43		74 58	282 05	73
74	71 47	19 15		19 82	276 15		75 61	285 51	74
75	72 44	19 41		20 09	279 90		76 65	289 77	75
76	73 40	19 67		20 36	283 63		77 69	293 64	76
77	74 38	19 93		20 63	287 36		78 72	297 50	77
78	75 34	20 19		20 90	291 09		79 75	301 37	78
79	76 30	20 45		21 16	294 12		80 79	305 23	79
80	77 27	20 71		21 44	298 56		81 82	309 10	80
81	78 23	20 97		21 70	302 29		82 86	312 06	81
82	79 20	21 23		21 97	306 02		83 90	315 52	82
83	80 16	21 49		22 24	309 75		84 93	319 39	83
84	81 13	21 75		22 50	313 49		85 96	323 25	84
85	82 10	22 00		22 77	317 22		86 00	327 11	85
86	83 06	22 26		23 04	320 95		87 04	330 98	86
87	84 03	22 52		23 31	324 68		88 07	334 85	87
88	85 00	22 78		23 56	328 41		89 11	338 70	88
89	86 06	23 04		23 84	332 13		90 14	342 55	89
90	86 93	23 29		24 12	335 88		91 18	346 41	90
91	87 90	23 55		24 38	339 61		92 21	350 26	91
92	88 86	24 01		24 65	343 34		93 25	354 11	92
93	89 83	24 07		24 92	347 07		94 28	357 96	93
94	90 80	24 33		25 18	350 80		95 32	361 81	94
95	91 76	24 59		25 45	354 54		96 35	365 66	95
96	92 73	24 85		25 72	358 27		97 39	369 51	96
97	93 70	25 11		25 99	362 00		98 42	373 37	97
98	94 66	25 37		26 26	365 73		99 46	377 22	98
99	95 63	25 63		26 52	369 46		100 49	381 07	99
100	96 59	25 88		26 80	373 20		101 53	384 92	100

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	15	74		16	74		16	74	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 00	00 28		00 29	3 49		01 01	3 53	1
2	01 01	00 55		00 57	6 57		02 02	7 26	2
3	02 02	01 22		01 00	10 46		03 03	10 88	3
4	03 03	01 49		01 15	13 95		04 04	14 51	4
5	04 04	02 16		01 43	17 41		05 05	18 14	5
6	05 05	02 43		01 72	20 92		06 06	21 77	6
7	06 06	03 10		02 01	24 41		07 07	25 40	7
8	07 07	03 37		02 15	27 90		08 08	26 02	8
9	08 08	04 04		02 29	31 39		09 09	32 65	9
10	09 09	04 31		02 43	34 87		10 10	36 28	10
11	10 10	05 04		03 16	38 36		11 11	39 50	11
12	11 11	05 31		03 44	41 35		12 12	41 53	12
13	12 12	06 05		04 13	45 34		13 13	47 16	13
14	13 13	06 38		04 41	48 32		14 14	50 79	14
15	14 14	07 11		05 10	52 31		15 15	54 42	15
16	15 15	07 44		05 39	55 80		16 16	58 04	16
17	16 16	08 17		06 07	59 29		17 17	61 67	17
18	17 17	08 50		06 35	62 77		18 18	64 30	18
19	18 18	09 23		07 03	66 26		19 19	67 52	19
20	19 19	09 56		07 31	69 75		20 20	72 56	20
21	20 20	10 29		08 00	73 24		21 21	76 18	21
22	21 21	11 02		08 28	76 72		22 22	79 81	22
23	22 22	11 35		08 56	80 21		23 23	83 44	23
24	23 23	12 08		09 25	83 70		24 24	87 06	24
25	24 24	12 41		09 53	87 19		25 25	90 69	25
26	25 25	13 14		10 22	90 67		26 26	94 32	26
27	26 26	13 47		10 50	94 16		27 27	97 94	27
28	27 27	14 20		11 19	97 65		28 28	101 57	28
29	28 28	14 53		11 47	101 14		29 29	105 20	29
30	29 29	15 26		12 16	104 62		30 30	108 84	30
31	30 30	15 59		12 44	108 11		31 31	112 46	31
32	31 31	16 32		13 13	111 60		32 32	116 08	32
33	32 32	17 05		13 41	115 09		33 33	119 71	33
34	33 33	17 38		14 10	118 57		34 34	123 34	34
35	34 34	18 11		14 38	122 06		35 35	126 96	35
36	35 35	18 44		15 07	125 55		36 36	130 59	36
37	36 36	19 17		15 35	129 04		37 37	134 22	37
38	37 37	19 50		16 04	132 52		38 38	137 86	38
39	38 38	20 23		16 32	136 01		39 39	141 48	39
40	39 39	20 56		17 01	139 50		40 40	145 12	40
41	40 40	21 29		17 29	142 99		41 41	148 74	41
42	41 41	22 02		17 58	146 47		42 42	152 37	42
43	42 42	22 35		18 26	149 56		43 43	155 98	43
44	43 43	23 08		18 55	153 05		44 44	158 61	44
45	44 44	23 41		19 23	156 94		45 45	163 24	45
46	45 45	24 14		19 52	160 42		46 46	166 86	46
47	46 46	24 47		20 20	163 91		47 47	170 50	47
48	47 47	25 20		20 49	167 40		48 48	174 14	48
49	48 48	25 53		21 17	170 89		49 49	177 75	49
50	49 49	26 26		21 46	174 37		50 50	181 40	50



Numbers	Sines Degrees			Tangents Degrees			Secants Degrees.		Numbers
	16	74		16	74		16	74	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	49 02	14 05		14 62	177 85		53 06	185 03	51
52	49 08	14 03		14 90	181 35		54 10	188 06	52
53	50 04	14 00		15 19	184 84		55 14	192 29	53
54	51 00	14 08		15 45	188 32		56 18	195 81	54
55	52 07	15 16		15 77	191 81		57 22	199 54	55
56	53 03	15 43		16 06	195 30		58 25	203 17	56
57	54 00	15 07		16 35	198 79		59 30	206 80	57
58	55 05	15 08		16 62	202 27		60 34	210 43	58
59	56 07	16 26		16 90	205 76		61 38	214 05	59
60	57 07	16 54		17 20	209 25		62 42	217 68	60
61	58 03	16 81		17 49	212 74		63 46	221 31	61
62	59 05	17 08		17 78	216 22		64 50	224 93	62
63	60 05	17 36		18 07	219 71		65 54	228 56	63
64	61 01	17 63		18 36	223 20		66 58	232 19	64
65	62 48	17 91		18 63	226 69		67 62	235 82	65
66	63 44	18 18		18 92	230 17		68 66	239 45	66
67	64 40	18 45		19 21	233 65		69 70	243 07	67
68	65 36	18 74		19 50	237 15		70 74	246 70	68
69	66 32	19 02		19 79	240 64		71 78	250 33	69
70	67 23	19 28		20 07	244 13		72 82	253 96	70
71	68 25	19 57		20 36	247 61		73 86	257 60	71
72	69 20	19 84		20 64	251 10		74 90	261 22	72
73	70 16	20 12		20 92	254 59		75 94	264 85	73
74	71 12	20 39		21 21	258 07		76 98	268 48	74
75	72 09	20 67		21 50	261 56		77 02	272 10	75
76	73 05	20 94		21 79	265 04		78 06	275 73	76
77	74 02	21 22		22 07	268 54		79 10	279 36	77
78	74 98	21 49		22 36	272 02		80 14	282 98	78
79	75 04	21 77		22 65	275 51		81 18	286 61	79
80	76 00	22 03		22 94	278 99		82 22	290 24	80
81	77 06	22 32		23 23	282 48		83 26	293 88	81
82	78 04	22 59		23 52	285 96		84 30	297 50	82
83	79 00	22 87		23 80	289 45		85 34	301 12	83
84	80 00	23 15		24 08	292 94		86 38	304 75	84
85	81 03	23 42		24 37	296 42		87 42	308 38	85
86	82 09	23 70		24 66	299 91		88 46	312 00	86
87	83 05	23 97		24 95	303 40		89 50	315 63	87
88	84 01	24 25		25 24	306 89		90 54	319 26	88
89	85 07	24 53		25 53	310 38		91 58	322 89	89
90	86 01	24 81		25 81	313 87		92 62	326 52	90
91	87 47	25 07		26 09	317 35		93 66	330 14	91
92	88 44	25 35		26 38	320 84		94 70	333 77	92
93	89 40	25 62		26 67	324 33		95 74	337 40	93
94	90 36	25 90		26 96	327 81		96 78	341 02	94
95	91 32	26 17		27 25	331 30		97 82	344 65	95
96	92 28	26 45		27 54	334 79		98 86	348 20	96
97	93 24	26 73		27 82	338 27		99 90	351 80	97
98	94 22	27 01		28 10	341 75		100 94	355 43	98
99	95 16	27 28		28 38	345 24		101 98	359 06	99
100	96 13	27 56		28 67	348 72		102 02	362 69	100



6 Rhumb and a half is 73 deg. 7 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	17	73		17	73		17	73	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 06	00 29	1	00 11	00 27	1	01 05	00 42	1
2	01 01	00 58	2	00 16	00 32	2	02 09	01 08	2
3	02 02	01 08	3	00 21	00 47	3	03 11	01 26	3
4	03 03	01 17	4	00 26	00 54	4	04 18	01 43	4
5	04 04	01 26	5	00 31	01 01	5	05 23	02 01	5
6	05 05	01 35	6	00 36	01 10	6	06 27	02 22	6
7	06 06	01 44	7	00 41	01 19	7	07 32	02 43	7
8	07 07	01 53	8	00 46	01 28	8	08 37	03 04	8
9	08 08	02 02	9	00 51	01 37	9	09 41	03 25	9
10	09 09	02 11	10	00 56	01 46	10	10 46	03 46	10
11	10 10	02 20	11	01 01	01 55	11	11 50	04 07	11
12	11 11	02 29	12	01 06	02 04	12	12 55	04 28	12
13	12 12	02 38	13	01 11	02 13	13	13 59	04 49	13
14	13 13	02 47	14	01 16	02 22	14	14 54	05 10	14
15	14 14	02 56	15	01 21	02 31	15	15 58	05 31	15
16	15 15	03 05	16	01 26	02 40	16	16 53	05 52	16
17	16 16	03 14	17	01 31	02 49	17	17 57	06 13	17
18	17 17	03 23	18	01 36	02 58	18	18 52	06 34	18
19	18 18	03 32	19	01 41	03 07	19	19 56	06 55	19
20	19 19	03 41	20	01 46	03 16	20	20 51	07 16	20
21	20 20	03 50	21	01 51	03 25	21	21 56	07 37	21
22	21 21	03 59	22	01 56	03 34	22	23 00	07 58	22
23	22 22	04 08	23	02 01	03 43	23	24 05	08 19	23
24	23 23	04 17	24	02 06	03 52	24	25 09	08 40	24
25	24 24	04 26	25	02 11	04 01	25	26 14	09 01	25
26	25 25	04 35	26	02 16	04 10	26	27 18	09 22	26
27	26 26	04 44	27	02 21	04 19	27	28 23	09 43	27
28	27 27	04 53	28	02 26	04 28	28	29 27	09 64	28
29	28 28	05 02	29	02 31	04 37	29	30 32	09 85	29
30	29 29	05 11	30	02 36	04 46	30	31 37	10 06	30
31	30 30	05 20	31	02 41	04 55	31	32 41	10 27	31
32	31 31	05 29	32	02 46	05 04	32	33 46	10 48	32
33	32 32	05 38	33	02 51	05 13	33	34 50	11 09	33
34	33 33	05 47	34	02 56	05 22	34	35 55	11 30	34
35	34 34	05 56	35	03 01	05 31	35	36 59	11 51	35
36	35 35	06 05	36	03 06	05 40	36	37 64	12 12	36
37	36 36	06 14	37	03 11	05 49	37	38 68	12 33	37
38	37 37	06 23	38	03 16	05 58	38	39 73	12 54	38
39	38 38	06 32	39	03 21	06 07	39	40 78	13 15	39
40	39 39	06 41	40	03 26	06 16	40	41 83	13 36	40
41	40 40	06 50	41	03 31	06 25	41	42 87	13 57	41
42	41 41	06 59	42	03 36	06 34	42	43 92	14 18	42
43	42 42	07 08	43	03 41	06 43	43	44 96	14 39	43
44	43 43	07 17	44	03 46	06 52	44	45 00	15 00	44
45	44 44	07 26	45	03 51	07 01	45	46 05	15 21	45
46	45 45	07 35	46	03 56	07 10	46	47 09	15 42	46
47	46 46	07 44	47	04 01	07 19	47	48 14	16 03	47
48	47 47	07 53	48	04 06	07 28	48	49 19	16 24	48
49	48 48	08 02	49	04 11	07 37	49	50 23	16 45	49
50	49 49	08 11	50	04 16	07 46	50	51 28	17 06	50

1 Rhumb and a half is 16 deg. 53 min.

1 Rhumb and a half is 16 deg. 53 min.

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	17	73		17	73		17	73	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	48 77	14 91		15 59	166 81		53 33	174 44	51
52	49 73	15 20		15 1 90	170 88		54 38	177 85	52
53	50 68	15 50		16 21	173 35		55 42	181 28	53
54	51 64	16 20		16 51	176 163		56 47	184 11 70	54
55	52 59	16 08		16 81	179 90		57 51	189 12	55
56	53 55	16 37		17 12	183 18		58 56	191 54	56
57	54 51	16 06		17 42	185 44		59 06	194 06	57
58	55 46	16 56		17 12 73	189 71		60 33	198 38	58
59	56 42	17 25		18 03	192 98		61 69	201 98	59
60	57 38	17 54		18 34	195 25		62 74	205 22	60
61	58 33	18 84		18 64	199 53		63 78	208 64	61
62	59 29	18 13		18 95	202 80		64 03	212 06	62
63	60 24	18 03		19 25	206 07		65 08	215 48	63
64	61 20	18 03 71		19 55	209 34		66 02	218 30	64
65	62 16	19 00		19 86	212 61		67 92	222 32	65
66	63 11	19 29		20 17	215 88		69 01	225 74	66
67	64 07	19 58		20 47	219 15		70 06	229 16	67
68	65 02	19 88		20 78	222 42		71 10	232 58	68
69	65 98	20 17		21 31	225 70		72 15	236 10	69
70	66 94	20 47		21 40	228 98		73 20	239 42	70
71	67 89	20 76		21 71	232 25		74 24	242 84	71
72	68 85	21 05		22 01	235 52		75 29	246 06	72
73	69 81	21 31		22 32	238 79		76 33	249 68	73
74	70 76	21 63		22 62	242 06		77 38	253 10	74
75	71 72	21 92		22 93	245 32		78 42	256 52	75
76	72 68	22 21		23 23	248 59		79 47	259 94	76
77	73 63	22 50		23 54	251 86		80 55	263 36	77
78	74 59	22 80		23 84	254 13		81 56	266 78	78
79	75 54	23 09		24 15	256 41		82 56	270 20	79
80	76 50	23 39		24 46	259 67		83 66	273 62	80
81	77 46	23 68		24 76	264 94		84 70	277 04	81
82	78 41	23 97		25 07	268 21		85 75	280 46	82
83	79 37	24 26		25 37	271 48		86 79	283 88	83
84	80 32	24 55		25 68	274 76		87 84	287 30	84
85	81 28	24 85		25 98	278 03		88 89	290 72	85
86	82 24	25 14		26 29	281 31		89 93	294 14	86
87	83 19	25 43		26 59	284 58		90 08	297 56	87
88	84 15	25 72		26 90	287 83		92 02	300 98	88
89	85 11	25 02		27 21	291 11		93 07	304 81	89
90	86 07	26 31		27 52	294 38		94 11	307 83	90
91	87 02	26 60		28 82	297 65		95 16	311 25	91
92	87 58	26 90		28 13	300 92		96 20	314 67	92
93	88 53	27 19		28 43	304 21		97 25	318 09	93
94	89 48	27 48		28 74	307 46		98 29	321 61	94
95	90 84	27 77		29 04	310 73		99 34	324 93	95
96	91 80	28 06		29 35	314 00		100 39	328 35	96
97	92 76	28 36		29 65	317 27		101 43	331 77	97
98	93 71	28 65		29 96	320 54		102 48	335 19	98
99	94 67	28 94		30 26	323 81		103 52	338 06	99
100	95 63	29 24		30 57	327 09		104 57	342 03	100

6 Rhumb and a half is 93 deg. 7 min.

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	18	72		18	72		18	72	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 55	00 55	00 55	00 32	03 08	01 05	03 24	03 24	1
2	01 10	00 56	00 56	00 33	03 16	02 10	03 47	03 47	2
3	01 25	00 57	00 57	00 34	03 23	03 15	03 51	03 51	3
4	01 40	00 58	00 58	00 35	03 31	04 21	04 04	04 04	4
5	01 55	00 59	00 59	00 36	03 39	05 26	04 18	04 18	5
6	02 10	01 00	01 00	00 37	03 47	06 31	05 25	05 25	6
7	02 25	01 01	01 01	00 38	03 54	07 36	06 25	06 25	7
8	02 40	01 02	01 02	00 39	04 02	08 41	07 19	07 19	8
9	02 55	01 03	01 03	00 40	04 10	09 46	08 12	08 12	9
10	03 10	01 04	01 04	00 41	04 18	10 51	09 05	09 05	10
11	03 25	01 05	01 05	00 42	04 26	11 57	10 00	10 00	11
12	03 40	01 06	01 06	00 43	04 34	12 02	11 00	11 00	12
13	03 55	01 07	01 07	00 44	04 42	13 07	12 00	12 00	13
14	04 10	01 08	01 08	00 45	04 50	14 12	13 00	13 00	14
15	04 25	01 09	01 09	00 46	04 58	15 17	14 00	14 00	15
16	04 40	01 10	01 10	00 47	05 06	16 22	15 00	15 00	16
17	04 55	01 11	01 11	00 48	05 14	17 27	16 00	16 00	17
18	05 10	01 12	01 12	00 49	05 22	18 32	17 00	17 00	18
19	05 25	01 13	01 13	00 50	05 30	19 37	18 00	18 00	19
20	05 40	01 14	01 14	00 51	05 38	20 42	19 00	19 00	20
21	05 55	01 15	01 15	00 52	05 46	21 47	20 00	20 00	21
22	06 10	01 16	01 16	00 53	05 54	22 52	21 00	21 00	22
23	06 25	01 17	01 17	00 54	06 02	23 57	22 00	22 00	23
24	06 40	01 18	01 18	00 55	06 10	24 02	23 00	23 00	24
25	06 55	01 19	01 19	00 56	06 18	25 07	24 00	24 00	25
26	07 10	01 20	01 20	00 57	06 26	26 12	25 00	25 00	26
27	07 25	01 21	01 21	00 58	06 34	27 17	26 00	26 00	27
28	07 40	01 22	01 22	00 59	06 42	28 22	27 00	27 00	28
29	07 55	01 23	01 23	01 00	06 50	29 27	28 00	28 00	29
30	08 10	01 24	01 24	01 01	06 58	30 32	29 00	29 00	30
31	08 25	01 25	01 25	01 02	07 06	31 37	30 00	30 00	31
32	08 40	01 26	01 26	01 03	07 14	32 42	31 00	31 00	32
33	08 55	01 27	01 27	01 04	07 22	33 47	32 00	32 00	33
34	09 10	01 28	01 28	01 05	07 30	34 52	33 00	33 00	34
35	09 25	01 29	01 29	01 06	07 38	35 57	34 00	34 00	35
36	09 40	01 30	01 30	01 07	07 46	36 02	35 00	35 00	36
37	09 55	01 31	01 31	01 08	07 54	37 07	36 00	36 00	37
38	10 10	01 32	01 32	01 09	08 02	38 12	37 00	37 00	38
39	10 25	01 33	01 33	01 10	08 10	39 17	38 00	38 00	39
40	10 40	01 34	01 34	01 11	08 18	40 22	39 00	39 00	40
41	10 55	01 35	01 35	01 12	08 26	41 27	40 00	40 00	41
42	11 10	01 36	01 36	01 13	08 34	42 32	41 00	41 00	42
43	11 25	01 37	01 37	01 14	08 42	43 37	42 00	42 00	43
44	11 40	01 38	01 38	01 15	08 50	44 42	43 00	43 00	44
45	11 55	01 39	01 39	01 16	08 58	45 47	44 00	44 00	45
46	12 10	01 40	01 40	01 17	09 06	46 52	45 00	45 00	46
47	12 25	01 41	01 41	01 18	09 14	47 57	46 00	46 00	47
48	12 40	01 42	01 42	01 19	09 22	48 02	47 00	47 00	48
49	12 55	01 43	01 43	01 20	09 30	49 07	48 00	48 00	49
50	13 10	01 44	01 44	01 21	09 38	50 12	49 00	49 00	50

Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	18	72	18	72	18	72	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
51	48 50	15 76	16 57	156 06	53 63	165 03	51
52	49 45	16 07	16 50	160 03	54 05	168 27	52
53	50 30	16 38	17 02	163 11	55 07	171 57	53
54	51 15	16 69	17 16	166 19	56 08	174 74	54
55	52 31	17 00	17 37	169 27	57 33	177 47	55
56	53 26	17 30	18 20	172 34	58 38	181 21	56
57	54 21	17 51	18 52	175 42	59 34	184 45	57
58	55 06	18 02	18 55	178 50	60 39	187 58	58
59	55 11	18 23	19 17	181 58	61 04	190 52	59
60	57 06	18 54	19 50	184 66	63 09	194 16	60
61	58 01	18 85	19 82	187 73	64 14	197 40	61
62	58 97	19 16	20 15	190 81	65 18	200 64	62
63	59 92	19 47	20 47	193 89	66 24	203 87	63
64	60 87	19 78	20 80	196 97	67 30	207 11	64
65	61 82	20 09	21 12	200 04	68 35	210 34	65
66	62 77	20 39	21 45	203 12	69 40	213 58	66
67	63 72	20 70	21 77	206 20	70 45	216 82	67
68	64 67	21 01	22 10	209 28	71 50	220 05	68
69	65 62	21 32	22 42	212 36	72 55	223 29	69
70	66 57	21 63	22 75	215 44	73 60	226 52	70
71	67 53	21 94	23 07	218 52	74 66	229 76	71
72	68 48	22 25	23 40	221 60	75 71	232 99	72
73	69 43	22 56	23 72	224 68	76 76	236 23	73
74	70 38	23 17	24 05	227 75	77 81	239 47	74
75	71 33	23 48	24 37	230 83	78 86	242 70	75
76	72 28	23 48	24 70	233 91	79 91	245 93	76
77	73 23	23 79	25 02	236 99	80 97	249 17	77
78	74 18	24 10	25 35	240 07	82 02	252 41	78
79	75 13	24 41	25 67	243 14	83 07	255 64	79
80	76 08	24 72	26 00	246 21	84 12	258 88	80
81	77 03	25 03	26 32	249 29	85 17	262 12	81
82	77 99	25 34	26 65	252 37	86 23	265 35	82
83	78 94	25 65	26 97	255 44	87 27	268 59	83
84	79 89	25 96	27 30	258 51	88 33	271 83	84
85	80 84	26 26	27 62	261 60	89 37	275 06	85
86	81 79	26 57	27 93	264 66	90 43	278 30	86
87	82 74	27 28	28 27	267 75	91 47	281 53	87
88	83 69	27 19	28 60	270 83	92 53	284 77	88
89	84 64	27 50	28 92	273 91	93 57	288 01	89
90	85 60	27 81	29 25	276 99	94 63	291 25	90
91	86 55	28 12	29 57	280 07	95 69	294 48	91
92	87 50	28 43	30 30	283 14	96 74	297 71	92
93	88 45	28 74	30 62	286 22	97 79	300 94	93
94	89 40	29 04	30 55	289 30	98 84	304 18	94
95	90 35	29 35	30 87	292 38	99 89	307 42	95
96	91 30	29 66	31 20	295 45	100 95	310 65	96
97	92 25	29 97	31 52	298 53	102 00	313 89	97
98	93 21	30 28	31 05	301 61	103 05	317 13	98
99	94 16	30 59	32 17	304 69	104 10	320 37	99
100	95 11	31 20	32 50	307 77	105 15	323 16	100

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	19	71		19	71		19	71	
1	00 00	00 00	1	00 00	2 00	1	00 00	07 00	1
2	01 00	00 01	2	00 01	2 01	2	01 00	07 01	2
3	02 00	00 02	3	00 02	2 02	3	02 00	07 02	3
4	03 00	00 03	4	00 03	2 03	4	03 00	07 03	4
5	04 00	00 04	5	00 04	2 04	5	04 00	07 04	5
6	05 00	00 05	6	00 05	2 05	6	05 00	07 05	6
7	06 00	00 06	7	00 06	2 06	7	06 00	07 06	7
8	07 00	00 07	8	00 07	2 07	8	07 00	07 07	8
9	08 00	00 08	9	00 08	2 08	9	08 00	07 08	9
10	09 00	00 09	10	00 09	2 09	10	09 00	07 09	10
11	10 00	00 10	11	00 10	2 10	11	10 00	07 10	11
12	11 00	00 11	12	00 11	2 11	12	11 00	07 11	12
13	12 00	00 12	13	00 12	2 12	13	12 00	07 12	13
14	13 00	00 13	14	00 13	2 13	14	13 00	07 13	14
15	14 00	00 14	15	00 14	2 14	15	14 00	07 14	15
16	15 00	00 15	16	00 15	2 15	16	15 00	07 15	16
17	16 00	00 16	17	00 16	2 16	17	16 00	07 16	17
18	17 00	00 17	18	00 17	2 17	18	17 00	07 17	18
19	18 00	00 18	19	00 18	2 18	19	18 00	07 18	19
20	19 00	00 19	20	00 19	2 19	20	19 00	07 19	20
21	20 00	00 20	21	00 20	2 20	21	20 00	07 20	21
22	21 00	00 21	22	00 21	2 21	22	21 00	07 21	22
23	22 00	00 22	23	00 22	2 22	23	22 00	07 22	23
24	23 00	00 23	24	00 23	2 23	24	23 00	07 23	24
25	24 00	00 24	25	00 24	2 24	25	24 00	07 24	25
26	25 00	00 25	26	00 25	2 25	26	25 00	07 25	26
27	26 00	00 26	27	00 26	2 26	27	26 00	07 26	27
28	27 00	00 27	28	00 27	2 27	28	27 00	07 27	28
29	28 00	00 28	29	00 28	2 28	29	28 00	07 28	29
30	29 00	00 29	30	00 29	2 29	30	29 00	07 29	30
31	30 00	00 30	31	00 30	2 30	31	30 00	07 30	31
32	31 00	00 31	32	00 31	2 31	32	31 00	07 31	32
33	32 00	00 32	33	00 32	2 32	33	32 00	07 32	33
34	33 00	00 33	34	00 33	2 33	34	33 00	07 33	34
35	34 00	00 34	35	00 34	2 34	35	34 00	07 34	35
36	35 00	00 35	36	00 35	2 35	36	35 00	07 35	36
37	36 00	00 36	37	00 36	2 36	37	36 00	07 36	37
38	37 00	00 37	38	00 37	2 37	38	37 00	07 37	38
39	38 00	00 38	39	00 38	2 38	39	38 00	07 38	39
40	39 00	00 39	40	00 39	2 39	40	39 00	07 39	40
41	40 00	00 40	41	00 40	2 40	41	40 00	07 40	41
42	41 00	00 41	42	00 41	2 41	42	41 00	07 41	42
43	42 00	00 42	43	00 42	2 42	43	42 00	07 42	43
44	43 00	00 43	44	00 43	2 43	44	43 00	07 43	44
45	44 00	00 44	45	00 44	2 44	45	44 00	07 44	45
46	45 00	00 45	46	00 45	2 45	46	45 00	07 45	46
47	46 00	00 46	47	00 46	2 46	47	46 00	07 46	47
48	47 00	00 47	48	00 47	2 47	48	47 00	07 47	48
49	48 00	00 48	49	00 48	2 48	49	48 00	07 48	49
50	49 00	00 49	50	00 49	2 49	50	49 00	07 49	50



Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	19	78	19	71	19	71	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
51	48 23	16 60	17 56	148 11	53 94	156 65	51
52	49 07	16 03	17 51	151 02	55 00	159 73	52
53	50 12	17 02	18 05	153 52	56 05	162 80	53
54	51 06	17 58	18 40	156 08	57 11	165 00	54
55	52 01	17 91	18 94	159 73	58 17	168 94	55
56	52 95	18 23	19 29	162 63	59 23	172 01	56
57	53 38	18 56	19 43	165 54	60 29	175 08	57
58	54 34	18 88	19 57	168 44	61 35	178 15	58
59	55 78	19 21	20 32	171 35	62 40	181 22	59
60	56 73	19 53	20 66	174 25	63 46	184 29	60
61	57 67	19 86	21 00	177 16	64 52	187 36	61
62	58 62	20 19	21 34	180 06	65 58	190 43	62
63	59 56	20 51	21 69	182 57	66 63	193 50	63
64	60 51	20 84	22 03	185 48	67 69	196 57	64
65	61 46	21 17	22 38	188 37	68 75	199 64	65
66	62 40	21 49	22 72	191 28	69 81	202 72	66
67	63 35	21 82	23 07	194 18	70 86	205 80	67
68	64 30	22 15	23 41	197 09	71 92	208 89	68
69	65 24	22 47	23 75	200 00	72 98	211 93	69
70	66 19	22 79	24 10	203 29	74 03	215 01	70
71	67 13	23 13	24 44	206 20	75 09	218 08	71
72	68 07	23 45	24 79	209 11	76 15	221 15	72
73	69 02	23 77	25 13	212 01	77 21	224 22	73
74	69 56	24 10	25 48	214 52	78 27	227 30	74
75	70 91	24 42	25 82	217 82	79 33	230 37	75
76	71 85	24 75	26 16	220 72	80 38	233 44	76
77	72 80	25 08	26 51	223 63	81 44	236 51	77
78	73 75	25 40	26 85	226 53	82 50	239 58	78
79	74 69	25 73	27 20	229 44	83 56	242 65	79
80	75 64	26 05	27 55	232 34	84 61	245 72	80
81	76 58	26 38	27 89	235 25	85 67	248 79	81
82	77 53	26 71	28 23	238 15	86 73	251 86	82
83	78 47	27 02	28 58	241 05	87 79	254 93	83
84	79 42	27 35	28 92	243 56	88 84	258 00	84
85	80 37	27 67	29 27	246 86	89 90	261 07	85
86	81 31	28 00	29 61	249 77	90 96	264 14	86
87	82 26	28 33	29 95	252 67	92 02	267 21	87
88	83 20	28 65	30 30	255 57	93 07	270 28	88
89	84 15	28 98	30 64	258 48	94 13	273 36	89
90	85 10	29 30	30 99	261 38	95 19	276 43	90
91	86 04	29 63	31 33	264 29	96 25	279 51	91
92	86 58	29 95	31 68	267 19	97 30	282 58	92
93	87 53	30 28	32 02	270 10	98 36	285 65	93
94	88 47	30 60	32 36	273 00	99 42	288 73	94
95	89 42	30 93	32 71	275 91	100 48	291 80	95
96	90 37	31 26	33 05	278 81	101 54	294 88	96
97	91 31	31 58	33 40	281 71	102 59	297 96	97
98	92 26	31 91	33 74	284 62	103 65	301 01	98
99	93 20	32 23	34 09	287 52	104 71	304 08	99
100	94 15	32 56	34 43	290 42	105 76	307 16	100



6 Rhumb and a quarter is 70 deg. 19 min.

Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	20	70	20	70	20	70	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
1	00 00	00 00	00 00	02 00	01 00	02 00	1
2	00 01	00 01	00 01	02 01	01 01	02 01	2
3	00 02	00 02	00 02	02 02	01 02	02 02	3
4	00 03	00 03	00 03	02 03	01 03	02 03	4
5	00 04	00 04	00 04	02 04	01 04	02 04	5
6	00 05	00 05	00 05	02 05	01 05	02 05	6
7	00 06	00 06	00 06	02 06	01 06	02 06	7
8	00 07	00 07	00 07	02 07	01 07	02 07	8
9	00 08	00 08	00 08	02 08	01 08	02 08	9
10	00 09	00 09	00 09	02 09	01 09	02 09	10
11	00 10	00 10	00 10	02 10	01 10	02 10	11
12	00 11	00 11	00 11	02 11	01 11	02 11	12
13	00 12	00 12	00 12	02 12	01 12	02 12	13
14	00 13	00 13	00 13	02 13	01 13	02 13	14
15	00 14	00 14	00 14	02 14	01 14	02 14	15
16	00 15	00 15	00 15	02 15	01 15	02 15	16
17	00 16	00 16	00 16	02 16	01 16	02 16	17
18	00 17	00 17	00 17	02 17	01 17	02 17	18
19	00 18	00 18	00 18	02 18	01 18	02 18	19
20	00 19	00 19	00 19	02 19	01 19	02 19	20
21	00 20	00 20	00 20	02 20	01 20	02 20	21
22	00 21	00 21	00 21	02 21	01 21	02 21	22
23	00 22	00 22	00 22	02 22	01 22	02 22	23
24	00 23	00 23	00 23	02 23	01 23	02 23	24
25	00 24	00 24	00 24	02 24	01 24	02 24	25
26	00 25	00 25	00 25	02 25	01 25	02 25	26
27	00 26	00 26	00 26	02 26	01 26	02 26	27
28	00 27	00 27	00 27	02 27	01 27	02 27	28
29	00 28	00 28	00 28	02 28	01 28	02 28	29
30	00 29	00 29	00 29	02 29	01 29	02 29	30
31	00 30	00 30	00 30	02 30	01 30	02 30	31
32	00 31	00 31	00 31	02 31	01 31	02 31	32
33	00 32	00 32	00 32	02 32	01 32	02 32	33
34	00 33	00 33	00 33	02 33	01 33	02 33	34
35	00 34	00 34	00 34	02 34	01 34	02 34	35
36	00 35	00 35	00 35	02 35	01 35	02 35	36
37	00 36	00 36	00 36	02 36	01 36	02 36	37
38	00 37	00 37	00 37	02 37	01 37	02 37	38
39	00 38	00 38	00 38	02 38	01 38	02 38	39
40	00 39	00 39	00 39	02 39	01 39	02 39	40
41	00 40	00 40	00 40	02 40	01 40	02 40	41
42	00 41	00 41	00 41	02 41	01 41	02 41	42
43	00 42	00 42	00 42	02 42	01 42	02 42	43
44	00 43	00 43	00 43	02 43	01 43	02 43	44
45	00 44	00 44	00 44	02 44	01 44	02 44	45
46	00 45	00 45	00 45	02 45	01 45	02 45	46
47	00 46	00 46	00 46	02 46	01 46	02 46	47
48	00 47	00 47	00 47	02 47	01 47	02 47	48
49	00 48	00 48	00 48	02 48	01 48	02 48	49
50	00 49	00 49	00 49	02 49	01 49	02 49	50

1 Rhumb and three quarters is 19 deg. 41 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	20	70		20	70		20	70	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	48	92	51	18	56	51	54	27	51
52	48	86	52	18	53	52	55	33	52
53	49	80	53	19	02	53	56	40	53
54	50	74	54	19	05	54	57	47	54
55	51	68	55	20	02	55	58	53	55
56	52	62	56	20	38	56	59	59	56
57	53	56	57	20	75	57	60	66	57
58	54	50	58	21	11	58	61	72	58
59	55	44	59	21	48	59	62	79	59
60	56	38	60	21	84	60	63	85	60
61	57	32	61	22	22	61	64	92	61
62	58	26	62	22	57	62	65	98	62
63	59	20	63	22	53	63	67	04	63
64	60	14	64	23	30	64	68	11	64
65	61	08	65	23	66	65	69	17	65
66	62	02	66	24	02	66	70	24	66
67	62	56	67	24	39	67	71	30	67
68	63	50	68	24	75	68	72	37	68
69	64	44	69	25	12	69	73	43	69
70	65	38	70	25	48	70	74	49	70
71	66	32	71	25	84	71	75	56	71
72	67	26	72	26	22	72	76	02	72
73	68	20	73	26	57	73	77	08	73
74	69	14	74	26	53	74	78	15	74
75	70	08	75	27	30	75	79	21	75
76	71	02	76	27	67	76	80	28	76
77	72	36	77	28	02	77	81	34	77
78	73	30	78	28	39	78	83	41	78
79	74	24	79	28	76	79	84	47	79
80	75	18	80	29	12	80	85	53	80
81	76	12	81	29	49	81	86	59	81
82	77	06	82	29	85	82	87	06	82
83	78	00	83	30	21	83	88	12	83
84	79	04	84	30	57	84	89	18	84
85	80	08	85	30	94	85	90	24	85
86	81	12	86	31	30	86	91	30	86
87	82	16	87	31	67	87	92	36	87
88	83	20	88	32	02	88	93	42	88
89	84	24	89	32	39	89	94	48	89
90	85	28	90	32	76	90	95	54	90
91	86	32	91	33	13	91	96	59	91
92	87	36	92	33	49	92	97	05	92
93	88	40	93	33	85	93	98	11	93
94	89	44	94	34	22	94	100	17	94
95	90	48	95	34	58	95	101	23	95
96	91	52	96	34	95	96	102	29	96
97	92	56	97	35	31	97	103	34	97
98	93	00	98	35	68	98	104	40	98
99	94	04	99	36	03	99	105	45	99
100	95	08	100	36	40	100	106	51	100

6 Rhumb and a quarter is 70 deg. 19 min.

Numbers	Sines			Tangents			Secants		Numbers
	21	69		21	69		21	69	
1	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
2	01 53	01 36	diff.	01 38	02 61	diff.	01 07	02 79	diff.
3	01 57	01 40	diff.	01 42	02 11	diff.	01 11	03 14	diff.
4	01 59	01 42	diff.	01 45	02 15	diff.	01 14	03 18	diff.
5	02 01	01 44	diff.	01 48	02 19	diff.	01 17	03 22	diff.
6	02 03	01 46	diff.	01 51	02 23	diff.	01 20	03 26	diff.
7	02 05	01 48	diff.	01 54	02 27	diff.	01 23	03 30	diff.
8	02 07	01 50	diff.	01 57	02 31	diff.	01 26	03 34	diff.
9	02 09	01 52	diff.	01 59	02 35	diff.	01 29	03 38	diff.
10	02 11	01 54	diff.	02 01	02 39	diff.	01 32	03 42	diff.
11	02 13	01 56	diff.	02 04	02 43	diff.	01 35	03 46	diff.
12	02 15	01 58	diff.	02 07	02 47	diff.	01 38	03 50	diff.
13	02 17	01 59	diff.	02 10	02 51	diff.	01 41	03 54	diff.
14	02 19	02 01	diff.	02 13	02 55	diff.	01 44	03 58	diff.
15	02 21	02 03	diff.	02 16	02 59	diff.	01 47	04 02	diff.
16	02 23	02 05	diff.	02 19	03 03	diff.	01 50	04 06	diff.
17	02 25	02 07	diff.	02 22	03 07	diff.	01 53	04 10	diff.
18	02 27	02 09	diff.	02 25	03 11	diff.	01 56	04 14	diff.
19	02 29	02 11	diff.	02 28	03 15	diff.	01 59	04 18	diff.
20	02 31	02 13	diff.	02 31	03 19	diff.	02 02	04 22	diff.
21	02 33	02 15	diff.	02 34	03 23	diff.	02 05	04 26	diff.
22	02 35	02 17	diff.	02 37	03 27	diff.	02 08	04 30	diff.
23	02 37	02 19	diff.	02 40	03 31	diff.	02 11	04 34	diff.
24	02 39	02 21	diff.	02 43	03 35	diff.	02 14	04 38	diff.
25	02 41	02 23	diff.	02 46	03 39	diff.	02 17	04 42	diff.
26	02 43	02 25	diff.	02 49	03 43	diff.	02 20	04 46	diff.
27	02 45	02 27	diff.	02 52	03 47	diff.	02 23	04 50	diff.
28	02 47	02 29	diff.	02 55	03 51	diff.	02 26	04 54	diff.
29	02 49	02 31	diff.	02 58	03 55	diff.	02 29	04 58	diff.
30	02 51	02 33	diff.	03 01	03 59	diff.	02 32	05 02	diff.
31	02 53	02 35	diff.	03 04	04 03	diff.	02 35	05 06	diff.
32	02 55	02 37	diff.	03 07	04 07	diff.	02 38	05 10	diff.
33	02 57	02 39	diff.	03 10	04 11	diff.	02 41	05 14	diff.
34	02 59	02 41	diff.	03 13	04 15	diff.	02 44	05 18	diff.
35	03 01	02 43	diff.	03 16	04 19	diff.	02 47	05 22	diff.
36	03 03	02 45	diff.	03 19	04 23	diff.	02 50	05 26	diff.
37	03 05	02 47	diff.	03 22	04 27	diff.	02 53	05 30	diff.
38	03 07	02 49	diff.	03 25	04 31	diff.	02 56	05 34	diff.
39	03 09	02 51	diff.	03 28	04 35	diff.	02 59	05 38	diff.
40	03 11	02 53	diff.	03 31	04 39	diff.	03 02	05 42	diff.
41	03 13	02 55	diff.	03 34	04 43	diff.	03 05	05 46	diff.
42	03 15	02 57	diff.	03 37	04 47	diff.	03 08	05 50	diff.
43	03 17	02 59	diff.	03 40	04 51	diff.	03 11	05 54	diff.
44	03 19	03 01	diff.	03 43	04 55	diff.	03 14	05 58	diff.
45	03 21	03 03	diff.	03 46	04 59	diff.	03 17	06 02	diff.
46	03 23	03 05	diff.	03 49	05 03	diff.	03 20	06 06	diff.
47	03 25	03 07	diff.	03 52	05 07	diff.	03 23	06 10	diff.
48	03 27	03 09	diff.	03 55	05 11	diff.	03 26	06 14	diff.
49	03 29	03 11	diff.	03 58	05 15	diff.	03 29	06 18	diff.
50	03 31	03 13	diff.	04 01	05 19	diff.	03 32	06 22	diff.

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	21	69		21	69		21	69	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	47 61	18 29		19 52	133 26		51 63	142 32	51
52	48 55	18 06		19 1 90	135 46		52 70	145 11	52
53	49 43	19 00 9		20 0 29	138 07		53 77	147 00	53
54	50 41	19 35		20 7 67	140 67		54 81	150 62	54
55	51 35	19 71		21 05	143 25		55 92	153 48	55
56	52 28	20 07		21 44	145 88		56 99	156 27	56
57	53 6 21	20 42		21 1 82	148 49		57 06	159 06	57
58	54 15	20 78		22 20	151 09		58 13	161 85	58
59	55 08	21 14		22 17 58	153 70		59 20	164 64	59
60	56 01	21 50		22 97	156 31		60 27	167 43	60
61	56 05	21 86		23 36	158 91		61 34	170 22	61
62	57 08	22 22		23 1 74	161 52		62 41	173 01	62
63	58 01	22 57		24 12	164 12		63 48	175 80	63
64	59 07	22 93		24 47 51	166 73		64 55	178 59	64
65	60 68	23 29		24 89	169 33		65 62	181 38	65
66	61 61	23 65		25 27	171 94		66 69	184 17	66
67	62 55	24 01		25 1 66	174 54		67 76	186 96	67
68	63 49	24 37		26 04	177 15		68 83	189 75	68
69	64 41	24 72		26 37 42	179 75		69 90	192 54	69
70	65 35	25 08		26 80	182 36		70 98	195 33	70
71	66 28	25 44		27 18	184 96		71 05	198 12	71
72	67 22	26 18		27 1 56	187 57		72 12	200 91	72
73	68 15	26 52		27 44 19	190 17		73 19	203 70	73
74	69 08	26 88		28 33	192 78		74 26	206 49	74
75	70 02	26 89		28 71	195 39		75 33	209 28	75
76	70 95	27 24		29 10	197 99		76 40	212 07	76
77	71 88	27 59		29 1 49	200 59		77 47	214 86	77
78	72 48	28 35		29 37 87	203 10		78 54	217 65	78
79	73 07	28 31		30 25	205 11		79 51	220 44	79
80	74 69	28 67		30 63	208 41		80 59	223 24	80
81	75 62	29 03		31 02	211 02		81 66	226 03	81
82	76 55	29 39		31 1 40	213 46		82 73	228 82	82
83	77 49	29 74		31 67 78	216 23		83 80	231 61	83
84	78 42	30 10		32 17	218 83		84 87	234 40	84
85	79 35	30 46		32 55	221 44		85 94	237 19	85
86	80 29	30 82		32 93	224 04		86 12	239 68	86
87	81 22	31 18		33 1 31	226 65		87 19	242 47	87
88	82 15	31 54		33 70	229 25		88 26	245 26	88
89	83 09	31 50		34 08	231 86		89 33	248 05	89
90	84 02	32 25		34 46	234 46		90 40	251 14	90
91	84 95	32 61		34 85	237 07		91 47	253 93	91
92	85 89	32 97		35 1 23	239 67		92 54	256 72	92
93	86 82	33 32		35 61	242 28		93 61	259 51	93
94	87 75	33 69		35 99	244 88		94 68	262 30	94
95	88 69	34 05		36 38	247 49		95 76	265 09	95
96	89 62	34 41		36 76	250 09		96 83	267 88	96
97	90 55	34 76		37 15	252 70		97 90	270 67	97
98	91 49	35 12		37 53	255 30		98 97	273 46	98
99	92 42	35 48		37 91	257 91		99 04	276 25	99
100	93 36	35 84		38 29	260 51		100 11	279 04	100

6 Rhumb is 67 deg. 30 min.

2 Rhumb is 22 deg. 30 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	22	68		22	68		22	68	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 00	00 00	1	00 00	00 00	1	01 00	00 00	1
2	01 00	00 00	2	01 00	00 00	2	02 00	00 00	2
3	02 00	00 00	3	02 00	00 00	3	03 00	00 00	3
4	03 00	00 00	4	03 00	00 00	4	04 00	00 00	4
5	04 00	00 00	5	04 00	00 00	5	05 00	00 00	5
6	05 00	00 00	6	05 00	00 00	6	06 00	00 00	6
7	06 00	00 00	7	06 00	00 00	7	07 00	00 00	7
8	07 00	00 00	8	07 00	00 00	8	08 00	00 00	8
9	08 00	00 00	9	08 00	00 00	9	09 00	00 00	9
10	09 00	00 00	10	09 00	00 00	10	10 00	00 00	10
11	10 00	00 00	11	10 00	00 00	11	11 00	00 00	11
12	11 00	00 00	12	11 00	00 00	12	12 00	00 00	12
13	12 00	00 00	13	12 00	00 00	13	13 00	00 00	13
14	13 00	00 00	14	13 00	00 00	14	14 00	00 00	14
15	14 00	00 00	15	14 00	00 00	15	15 00	00 00	15
16	15 00	00 00	16	15 00	00 00	16	16 00	00 00	16
17	16 00	00 00	17	16 00	00 00	17	17 00	00 00	17
18	17 00	00 00	18	17 00	00 00	18	18 00	00 00	18
19	18 00	00 00	19	18 00	00 00	19	19 00	00 00	19
20	19 00	00 00	20	19 00	00 00	20	20 00	00 00	20
21	20 00	00 00	21	20 00	00 00	21	21 00	00 00	21
22	21 00	00 00	22	21 00	00 00	22	22 00	00 00	22
23	22 00	00 00	23	22 00	00 00	23	23 00	00 00	23
24	23 00	00 00	24	23 00	00 00	24	24 00	00 00	24
25	24 00	00 00	25	24 00	00 00	25	25 00	00 00	25
26	25 00	00 00	26	25 00	00 00	26	26 00	00 00	26
27	26 00	00 00	27	26 00	00 00	27	27 00	00 00	27
28	27 00	00 00	28	27 00	00 00	28	28 00	00 00	28
29	28 00	00 00	29	28 00	00 00	29	29 00	00 00	29
30	29 00	00 00	30	29 00	00 00	30	30 00	00 00	30
31	30 00	00 00	31	30 00	00 00	31	31 00	00 00	31
32	31 00	00 00	32	31 00	00 00	32	32 00	00 00	32
33	32 00	00 00	33	32 00	00 00	33	33 00	00 00	33
34	33 00	00 00	34	33 00	00 00	34	34 00	00 00	34
35	34 00	00 00	35	34 00	00 00	35	35 00	00 00	35
36	35 00	00 00	36	35 00	00 00	36	36 00	00 00	36
37	36 00	00 00	37	36 00	00 00	37	37 00	00 00	37
38	37 00	00 00	38	37 00	00 00	38	38 00	00 00	38
39	38 00	00 00	39	38 00	00 00	39	39 00	00 00	39
40	39 00	00 00	40	39 00	00 00	40	40 00	00 00	40
41	40 00	00 00	41	40 00	00 00	41	41 00	00 00	41
42	41 00	00 00	42	41 00	00 00	42	42 00	00 00	42
43	42 00	00 00	43	42 00	00 00	43	43 00	00 00	43
44	43 00	00 00	44	43 00	00 00	44	44 00	00 00	44
45	44 00	00 00	45	44 00	00 00	45	45 00	00 00	45
46	45 00	00 00	46	45 00	00 00	46	46 00	00 00	46
47	46 00	00 00	47	46 00	00 00	47	47 00	00 00	47
48	47 00	00 00	48	47 00	00 00	48	48 00	00 00	48
49	48 00	00 00	49	48 00	00 00	49	49 00	00 00	49
50	49 00	00 00	50	49 00	00 00	50	50 00	00 00	50



2 Rhumb is 22 deg. 30 min.

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	22	68		22	68		22	68	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	47 28	19 10		20 60	126 23		55 00	136 14	51
52	48 21	19 04		21 01	128 07		56 08	138 14	52
53	49 14	19 00		21 41	131 18		57 16	141 14	53
54	50 06	20 03		21 82	133 06		58 24	144 15	54
55	50 59	20 60		22 22	136 13		59 31	146 83	55
56	51 52	20 98		22 62	138 60		60 39	149 49	56
57	52 44	21 03		23 03	141 08		61 47	152 16	57
58	53 37	21 07		23 43	143 55		62 55	154 81	58
59	54 30	22 10		23 84	146 03		63 63	157 50	59
60	55 63	22 48		24 24	148 51		64 71	160 17	60
61	56 55	22 85		24 64	150 99		65 79	162 85	61
62	57 48	23 10		25 05	153 06		66 86	165 51	62
63	58 41	23 60		25 45	155 14		67 94	168 18	63
64	59 34	23 01		25 86	158 41		69 02	170 86	64
65	60 26	24 35		26 26	160 89		70 10	173 52	65
66	61 19	24 73		26 66	162 36		71 18	176 18	66
67	62 12	25 10		27 07	165 84		72 26	178 86	67
68	63 04	25 48		27 47	168 31		73 33	181 52	68
69	63 97	25 85		27 88	170 79		74 41	184 18	69
70	64 90	26 22		28 28	173 26		75 50	186 86	70
71	65 83	26 59		28 68	175 74		76 57	189 52	71
72	66 75	26 97		29 09	178 21		77 06	192 19	72
73	67 68	27 34		29 49	180 68		78 14	194 87	73
74	68 61	27 72		30 90	183 16		79 22	197 53	74
75	69 54	28 09		30 30	185 64		80 30	200 20	75
76	70 46	28 47		30 71	188 11		81 38	202 88	76
77	71 39	28 84		31 11	190 59		82 46	205 54	77
78	72 32	29 21		31 51	193 06		83 54	208 21	78
79	73 24	29 59		31 92	195 54		84 61	210 89	79
80	74 17	29 97		32 22	198 01		85 68	213 56	80
81	75 10	30 34		32 72	200 49		87 36	216 22	81
82	76 03	30 72		33 13	202 96		88 43	218 90	82
83	76 95	31 09		33 53	205 44		89 51	221 56	83
84	77 88	31 47		33 94	207 91		90 58	224 23	84
85	78 81	31 84		34 34	210 39		91 67	226 91	85
86	79 74	32 21		34 74	212 86		92 75	229 57	86
87	80 66	32 59		35 15	215 34		93 83	232 24	87
88	81 59	32 97		35 55	217 81		94 90	234 92	88
89	82 52	33 34		35 96	220 29		95 98	237 58	89
90	83 45	33 71		36 36	222 76		97 07	240 25	90
91	84 38	34 08		36 76	225 24		98 14	242 93	91
92	85 31	34 46		37 17	227 71		99 22	245 59	92
93	86 24	34 83		37 57	230 19		100 30	248 26	93
94	87 16	35 20		37 98	232 66		101 38	250 94	94
95	88 09	35 58		38 38	235 14		102 45	253 60	95
96	89 02	35 95		38 78	237 61		103 53	256 27	96
97	89 94	36 33		39 19	239 99		104 61	258 95	97
98	90 87	36 70		39 59	242 56		105 69	261 61	98
99	91 80	37 08		40 00	245 04		106 77	264 28	99
100	92 72	37 46		40 40	247 51		107 85	266 95	100

6 Rhumb is 67 deg. 30 min.



6 Rhumb is 67 deg. 30 min.

2 Rhumb is 22 deg. 30 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers		
	23	67		23	67		23	67			
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.			
1	00	00	1	00	00	1	01	02	1	00	00
2	01	01	2	01	01	2	02	03	2	01	01
3	02	02	3	02	02	3	03	04	3	02	02
4	03	03	4	03	03	4	04	05	4	03	03
5	04	04	5	04	04	5	05	06	5	04	04
6	05	05	6	05	05	6	06	07	6	05	05
7	06	06	7	06	06	7	07	08	7	06	06
8	07	07	8	07	07	8	08	09	8	07	07
9	08	08	9	08	08	9	09	10	9	08	08
10	09	09	10	09	09	10	10	11	10	09	09
11	10	10	11	10	10	11	11	12	11	10	10
12	11	11	12	11	11	12	12	13	12	11	11
13	12	12	13	12	12	13	13	14	13	12	12
14	13	13	14	13	13	14	14	15	14	13	13
15	14	14	15	14	14	15	15	16	15	14	14
16	15	15	16	15	15	16	16	17	16	15	15
17	16	16	17	16	16	17	17	18	17	16	16
18	17	17	18	17	17	18	18	19	18	17	17
19	18	18	19	18	18	19	19	20	19	18	18
20	19	19	20	19	19	20	20	21	20	19	19
21	20	20	21	20	20	21	21	22	21	20	20
22	21	21	22	21	21	22	22	23	22	21	21
23	22	22	23	22	22	23	23	24	23	22	22
24	23	23	24	23	23	24	24	25	24	23	23
25	24	24	25	24	24	25	25	26	25	24	24
26	25	25	26	25	25	26	26	27	26	25	25
27	26	26	27	26	26	27	27	28	27	26	26
28	27	27	28	27	27	28	28	29	28	27	27
29	28	28	29	28	28	29	29	30	29	28	28
30	29	29	30	29	29	30	30	31	30	29	29
31	30	30	31	30	30	31	31	32	31	30	30
32	31	31	32	31	31	32	32	33	32	31	31
33	32	32	33	32	32	33	33	34	33	32	32
34	33	33	34	33	33	34	34	35	34	33	33
35	34	34	35	34	34	35	35	36	35	34	34
36	35	35	36	35	35	36	36	37	36	35	35
37	36	36	37	36	36	37	37	38	37	36	36
38	37	37	38	37	37	38	38	39	38	37	37
39	38	38	39	38	38	39	39	40	39	38	38
40	39	39	40	39	39	40	40	41	40	39	39
41	40	40	41	40	40	41	41	42	41	40	40
42	41	41	42	41	41	42	42	43	42	41	41
43	42	42	43	42	42	43	43	44	43	42	42
44	43	43	44	43	43	44	44	45	44	43	43
45	44	44	45	44	44	45	45	46	45	44	44
46	45	45	46	45	45	46	46	47	46	45	45
47	46	46	47	46	46	47	47	48	47	46	46
48	47	47	48	47	47	48	48	49	48	47	47
49	48	48	49	48	48	49	49	50	49	48	48
50	49	49	50	49	49	50	50	51	50	49	49
51	50	50	51	50	50	51	51	52	51	50	50
52	51	51	52	51	51	52	52	53	52	51	51
53	52	52	53	52	52	53	53	54	53	52	52
54	53	53	54	53	53	54	54	55	54	53	53
55	54	54	55	54	54	55	55	56	55	54	54
56	55	55	56	55	55	56	56	57	56	55	55
57	56	56	57	56	56	57	57	58	57	56	56
58	57	57	58	57	57	58	58	59	58	57	57
59	58	58	59	58	58	59	59	60	59	58	58
60	59	59	60	59	59	60	60	61	60	59	59
61	60	60	61	60	60	61	61	62	61	60	60
62	61	61	62	61	61	62	62	63	62	61	61
63	62	62	63	62	62	63	63	64	63	62	62
64	63	63	64	63	63	64	64	65	64	63	63
65	64	64	65	64	64	65	65	66	65	64	64
66	65	65	66	65	65	66	66	67	66	65	65
67	66	66	67	66	66	67	67	68	67	66	66
68	67	67	68	67	67	68	68	69	68	67	67
69	68	68	69	68	68	69	69	70	69	68	68
70	69	69	70	69	69	70	70	71	70	69	69
71	70	70	71	70	70	71	71	72	71	70	70
72	71	71	72	71	71	72	72	73	72	71	71
73	72	72	73	72	72	73	73	74	73	72	72
74	73	73	74	73	73	74	74	75	74	73	73
75	74	74	75	74	74	75	75	76	75	74	74
76	75	75	76	75	75	76	76	77	76	75	75
77	76	76	77	76	76	77	77	78	77	76	76
78	77	77	78	77	77	78	78	79	78	77	77
79	78	78	79	78	78	79	79	80	79	78	78
80	79	79	80	79	79	80	80	81	80	79	79
81	80	80	81	80	80	81	81	82	81	80	80
82	81	81	82	81	81	82	82	83	82	81	81
83	82	82	83	82	82	83	83	84	83	82	82
84	83	83	84	83	83	84	84	85	84	83	83
85	84	84	85	84	84	85	85	86	85	84	84
86	85	85	86	85	85	86	86	87	86	85	85
87	86	86	87	86	86	87	87	88	87	86	86
88	87	87	88	87	87	88	88	89	88	87	87
89	88	88	89	88	88	89	89	90	89	88	88
90	89	89	90	89	89	90	90	91	90	89	89
91	90	90	91	90	90	91	91	92	91	90	90
92	91	91	92	91	91	92	92	93	92	91	91
93	92	92	93	92	92	93	93	94	93	92	92
94	93	93	94	93	93	94	94	95	94	93	93
95	94	94	95	94	94	95	95	96	95	94	94
96	95	95	96	95	95	96	96	97	96	95	95
97	96	96	97	96	96	97	97	98	97	96	96
98	97	97	98	97	97	98	98	99	98	97	97
99	98	98	99	98	98	99	99	100	99	98	98
100	99	99	100	99	99	100	100	101	100	99	99

a Rhumb is 22 deg. 30 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants. Degrees.		Numbers
	23	67		2	67		23	67	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	46 95	19 93	21	65	120 15	55	40	130 51	51
52	47 87	20 32	22	07	122 30	56	49	133 07	52
53	48 79	20 57	22	10	124 36	57	53	135 36	53
54	49 71	21 10	22	19	127 02	58	66	138 19	54
55	50 63	21 49	23	35	129 57	59	75	140 76	55
56	51 55	21 88	23	77	131 92	60	83	143 32	56
57	52 47	22 02	24	120	134 28	61	92	146 88	57
58	53 39	22 66	24	162	136 64	62	01	148 44	58
59	54 31	23 05	25	25	138 99	63	09	151 00	59
60	55 23	23 44	25	47	141 32	65	18	153 56	60
61	56 15	23 83	25	89	143 70	66	26	156 12	61
62	57 07	24 22	26	132	145 06	67	35	158 68	62
63	57 99	24 01	26	174	147 42	68	44	161 24	63
64	58 91	25 01	27	17	150 78	69	53	163 80	64
65	59 83	25 40	27	59	153 13	70	62	166 36	65
66	60 75	25 79	28	02	155 48	71	70	168 92	66
67	61 67	26 18	28	144	157 84	72	79	171 47	67
68	62 59	26 57	28	187	160 19	73	87	174 03	68
69	63 51	26 96	29	25	162 55	74	96	176 59	69
70	64 43	27 35	29	71	164 91	76	05	179 15	70
71	65 36	27 74	30	14	167 27	77	14	181 71	71
72	66 28	28 13	30	177	169 63	78	22	184 27	72
73	67 20	28 52	30	299	171 98	79	31	186 83	73
74	68 12	29 31	31	41	174 34	80	39	189 39	74
75	69 04	29 31	31	44	176 70	81	48	191 95	75
76	69 66	29 70	32	26	179 05	82	57	194 50	76
77	70 38	30 09	32	69	181 41	83	65	197 05	77
78	71 30	30 48	33	11	183 77	84	74	199 62	78
79	72 22	30 87	33	54	186 12	85	82	202 18	79
80	73 14	31 26	33	96	188 47	86	91	204 74	80
81	74 06	31 65	34	39	190 83	88	00	207 31	81
82	75 48	32 04	34	81	193 18	89	09	209 87	82
83	76 40	32 43	35	23	195 54	90	17	212 43	83
84	77 32	32 82	35	66	197 89	91	26	214 99	84
85	78 24	33 21	36	08	200 25	92	35	217 54	85
86	79 16	33 60	36	51	202 61	93	43	220 10	86
87	80 08	33 99	36	93	204 96	94	52	222 66	87
88	81 00	34 38	37	36	207 32	95	60	225 22	88
89	81 52	34 77	37	78	209 68	96	69	227 78	89
90	82 44	35 17	38	20	212 03	97	77	230 34	90
91	83 37	35 56	38	63	214 39	98	86	232 90	91
92	84 29	35 95	39	05	216 74	99	95	235 46	92
93	85 21	36 34	39	48	219 10	101	03	238 02	93
94	86 13	36 73	39	90	221 45	102	12	241 57	94
95	87 05	37 12	40	32	223 81	103	21	243 13	95
96	88 37	37 51	40	75	226 17	104	29	245 69	96
97	89 29	37 90	41	18	228 52	105	37	248 25	97
98	90 21	38 29	41	60	230 88	106	46	250 81	98
99	91 13	38 68	42	03	233 23	107	55	253 37	99
100	92 05	39 07	42	45	235 58	108	64	255 93	100

6 Rhumb is 67 deg. 30 min.

Numbers	Sines Degrees		Tangents Degrees	Secants Degrees	Numbers
	24	66	24	66	
	N. pts.	N. pts.	N. pts.	N. pts.	
1	00 91	05 41	00 45	02 25	1
2	01 83	05 31	01 39	02 49	2
3	02 74	05 22	01 34	03 14	3
4	03 65	05 13	01 28	03 38	4
5	04 57	05 03	02 23	04 08	5
6	05 48	04 54	02 67	04 38	6
7	06 39	04 45	03 02	05 08	7
8	07 31	04 35	03 36	05 38	8
9	08 22	04 26	04 17	06 08	9
10	09 14	04 17	04 45	06 38	10
11	10 05	04 08	05 09	07 08	11
12	10 56	03 58	05 34	07 38	12
13	11 47	03 49	05 58	08 08	13
14	12 38	03 39	06 23	08 38	14
15	13 29	03 30	06 47	09 08	15
16	14 20	03 20	07 12	09 38	16
17	15 11	03 11	07 36	10 08	17
18	16 02	03 02	08 01	10 38	18
19	16 53	02 53	08 25	11 08	19
20	17 44	02 44	08 49	11 38	20
21	18 35	02 35	09 13	12 08	21
22	19 26	02 26	09 38	12 38	22
23	20 17	02 17	10 02	13 08	23
24	21 08	02 08	10 26	13 38	24
25	21 59	02 00	10 50	14 08	25
26	22 50	01 51	11 14	14 38	26
27	23 41	01 42	11 38	15 08	27
28	24 32	01 33	12 02	15 38	28
29	25 23	01 24	12 26	16 08	29
30	26 14	01 15	12 50	16 38	30
31	27 05	01 06	13 14	17 08	31
32	27 56	00 57	13 38	17 38	32
33	28 47	00 48	14 02	18 08	33
34	29 38	00 39	14 26	18 38	34
35	30 29	00 30	14 50	19 08	35
36	31 20	00 21	15 14	19 38	36
37	32 11	00 12	15 38	20 08	37
38	33 02	00 03	16 02	20 38	38
39	33 53	00 00	16 26	21 08	39
40	34 44	00 00	16 50	21 38	40
41	35 35	00 00	17 14	22 08	41
42	36 26	00 00	17 38	22 38	42
43	37 17	00 00	18 02	23 08	43
44	38 08	00 00	18 26	23 38	44
45	38 99	00 00	18 50	24 08	45
46	39 00	00 00	19 14	24 38	46
47	40 01	00 00	19 38	25 08	47
48	40 52	00 00	19 62	25 38	48
49	41 43	00 00	20 04	26 08	49
50	42 34	00 00	20 28	26 38	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	24	66		24	66		24	66	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	46 59	20 74		22 70	114 56		55 83	125 39	51
52	47 50	21 15		23 15	116 00		56 02	127 05	52
53	48 42	21 55		23 59	119 04		58 02	130 31	53
54	49 33	21 96		24 01	121 29		59 11	132 77	54
55	50 24	22 37		24 48	123 34		60 21	135 23	55
56	51 16	22 77		24 93	125 78		61 30	137 69	56
57	52 07	23 18		25 38	128 03		62 40	140 15	57
58	52 58	23 59		25 82	130 27		63 49	142 61	58
59	53 49	23 99		26 26	132 52		64 59	145 06	59
60	54 41	24 40		26 71	134 76		65 68	147 52	60
61	55 32	24 81		27 16	137 00		66 78	149 98	61
62	56 24	25 22		27 60	139 25		67 87	152 44	62
63	57 15	25 63		28 05	141 50		68 97	154 90	63
64	58 06	26 03		28 49	143 74		70 06	157 35	64
65	58 58	26 44		29 94	145 99		71 16	159 92	65
66	59 49	26 85		29 39	148 23		72 25	162 27	66
67	60 40	27 25		29 83	150 45		73 34	164 93	67
68	61 31	27 66		30 27	152 72		74 44	167 19	68
69	62 22	28 07		30 72	154 98		75 53	169 65	69
70	63 13	28 47		31 17	157 22		76 62	172 10	70
71	64 04	28 88		31 61	159 47		77 72	174 56	71
72	64 55	29 29		32 06	161 71		78 81	177 01	72
73	65 46	29 69		32 50	163 97		79 91	179 47	73
74	66 37	30 10		32 95	166 21		81 00	181 93	74
75	67 28	30 51		33 40	168 45		82 10	184 39	75
76	68 19	30 91		33 84	170 70		83 19	186 85	76
77	69 10	31 32		34 28	172 95		84 29	189 31	77
78	70 01	31 73		34 73	175 19		85 38	191 77	78
79	70 52	32 13		35 18	177 44		86 48	194 23	79
80	71 43	32 54		35 62	179 68		87 57	196 69	80
81	72 34	32 95		36 07	181 93		88 66	199 15	81
82	73 25	33 35		36 51	184 18		89 76	201 61	82
83	74 16	33 76		37 36	186 42		90 85	204 06	83
84	75 07	34 17		37 81	188 67		91 95	206 52	84
85	75 58	34 57		38 26	190 91		93 04	208 99	85
86	76 49	34 98		38 71	193 17		94 14	211 44	86
87	77 40	35 39		39 16	195 41		95 23	213 90	87
88	78 31	35 79		39 61	197 65		96 33	216 35	88
89	79 22	36 20		40 07	199 90		97 43	218 82	89
90	80 13	36 61		40 52	202 14		98 51	221 27	90
91	81 04	37 01		41 47	204 39		99 61	223 93	91
92	81 55	37 42		41 92	206 64		100 70	226 19	92
93	82 46	37 83		42 37	208 88		101 80	228 65	93
94	83 37	38 23		42 82	211 13		102 89	231 10	94
95	84 28	38 64		43 27	213 38		103 99	233 56	95
96	85 19	39 05		43 72	215 62		105 08	236 01	96
97	86 10	39 45		44 17	217 87		106 18	238 47	97
98	87 01	39 86		44 62	220 11		107 27	240 93	98
99	87 52	40 27		45 08	222 37		108 37	243 39	99
100	88 43	40 67		45 52	224 60		109 46	245 86	100

5 Rhumb and three quarters is 64 deg. 41 min.

2 Rhumb and a quarter is 25 deg. 19 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	25	65		25	65		25	65	
1	N. pts.	N. pts.	1	N. pts.	N. pts.	1	N. pts.	N. pts.	1
2	00 00	00 00	2	00 00	00 00	2	00 00	00 00	2
3	00 01	00 01	3	00 01	00 01	3	00 01	00 01	3
4	00 02	00 02	4	00 02	00 02	4	00 02	00 02	4
5	00 03	00 03	5	00 03	00 03	5	00 03	00 03	5
6	00 04	00 04	6	00 04	00 04	6	00 04	00 04	6
7	00 05	00 05	7	00 05	00 05	7	00 05	00 05	7
8	00 06	00 06	8	00 06	00 06	8	00 06	00 06	8
9	00 07	00 07	9	00 07	00 07	9	00 07	00 07	9
10	00 08	00 08	10	00 08	00 08	10	00 08	00 08	10
11	00 09	00 09	11	00 09	00 09	11	00 09	00 09	11
12	00 10	00 10	12	00 10	00 10	12	00 10	00 10	12
13	00 11	00 11	13	00 11	00 11	13	00 11	00 11	13
14	00 12	00 12	14	00 12	00 12	14	00 12	00 12	14
15	00 13	00 13	15	00 13	00 13	15	00 13	00 13	15
16	00 14	00 14	16	00 14	00 14	16	00 14	00 14	16
17	00 15	00 15	17	00 15	00 15	17	00 15	00 15	17
18	00 16	00 16	18	00 16	00 16	18	00 16	00 16	18
19	00 17	00 17	19	00 17	00 17	19	00 17	00 17	19
20	00 18	00 18	20	00 18	00 18	20	00 18	00 18	20
21	00 19	00 19	21	00 19	00 19	21	00 19	00 19	21
22	00 20	00 20	22	00 20	00 20	22	00 20	00 20	22
23	00 21	00 21	23	00 21	00 21	23	00 21	00 21	23
24	00 22	00 22	24	00 22	00 22	24	00 22	00 22	24
25	00 23	00 23	25	00 23	00 23	25	00 23	00 23	25
26	00 24	00 24	26	00 24	00 24	26	00 24	00 24	26
27	00 25	00 25	27	00 25	00 25	27	00 25	00 25	27
28	00 26	00 26	28	00 26	00 26	28	00 26	00 26	28
29	00 27	00 27	29	00 27	00 27	29	00 27	00 27	29
30	00 28	00 28	30	00 28	00 28	30	00 28	00 28	30
31	00 29	00 29	31	00 29	00 29	31	00 29	00 29	31
32	00 30	00 30	32	00 30	00 30	32	00 30	00 30	32
33	00 31	00 31	33	00 31	00 31	33	00 31	00 31	33
34	00 32	00 32	34	00 32	00 32	34	00 32	00 32	34
35	00 33	00 33	35	00 33	00 33	35	00 33	00 33	35
36	00 34	00 34	36	00 34	00 34	36	00 34	00 34	36
37	00 35	00 35	37	00 35	00 35	37	00 35	00 35	37
38	00 36	00 36	38	00 36	00 36	38	00 36	00 36	38
39	00 37	00 37	39	00 37	00 37	39	00 37	00 37	39
40	00 38	00 38	40	00 38	00 38	40	00 38	00 38	40
41	00 39	00 39	41	00 39	00 39	41	00 39	00 39	41
42	00 40	00 40	42	00 40	00 40	42	00 40	00 40	42
43	00 41	00 41	43	00 41	00 41	43	00 41	00 41	43
44	00 42	00 42	44	00 42	00 42	44	00 42	00 42	44
45	00 43	00 43	45	00 43	00 43	45	00 43	00 43	45
46	00 44	00 44	46	00 44	00 44	46	00 44	00 44	46
47	00 45	00 45	47	00 45	00 45	47	00 45	00 45	47
48	00 46	00 46	48	00 46	00 46	48	00 46	00 46	48
49	00 47	00 47	49	00 47	00 47	49	00 47	00 47	49
50	00 48	00 48	50	00 48	00 48	50	00 48	00 48	50



2 Rhumb and a quarter is 85 deg. 19 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants. Degrees.		Numbers
	25	65		25	65		25	65	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	46 22	21 55	51	23 79	109 37	51	56 27	120 69	51
52	47 03	21 09	52	24 12	110 51	52	57 03	121 05	52
53	47 43	21 24	53	24 45	111 06	53	57 44	121 58	53
54	48 24	21 39	54	25 19	111 58	54	58 25	122 51	54
55	49 05	21 54	55	25 52	112 50	55	59 06	123 44	55
56	49 46	22 09	56	26 25	113 42	56	59 47	124 37	56
57	50 27	22 24	57	26 58	114 34	57	60 28	125 30	57
58	51 08	22 39	58	27 31	115 26	58	61 09	126 22	58
59	51 49	22 54	59	28 04	116 18	59	61 50	127 15	59
60	52 30	23 09	60	28 37	117 10	60	62 31	128 08	60
61	53 11	23 24	61	29 10	118 02	61	63 12	129 00	61
62	53 52	23 39	62	29 43	118 54	62	63 53	130 00	62
63	54 33	23 54	63	30 16	119 46	63	64 34	131 00	63
64	55 14	24 09	64	30 49	120 38	64	65 15	132 00	64
65	55 55	24 24	65	31 22	121 30	65	65 56	133 00	65
66	56 36	24 39	66	31 55	122 22	66	66 37	134 00	66
67	57 17	24 54	67	32 28	123 14	67	67 18	135 00	67
68	57 58	25 09	68	33 01	124 06	68	67 59	136 00	68
69	58 39	25 24	69	33 34	124 98	69	68 40	137 00	69
70	59 20	25 39	70	34 07	125 00	70	69 21	138 00	70
71	60 01	25 54	71	34 40	125 52	71	70 02	139 00	71
72	60 42	26 09	72	35 13	126 44	72	70 43	140 00	72
73	61 23	26 24	73	35 46	127 36	73	71 24	141 00	73
74	62 04	26 39	74	36 19	128 28	74	72 05	142 00	74
75	62 45	26 54	75	36 52	129 20	75	72 46	143 00	75
76	63 26	27 09	76	37 25	130 12	76	73 27	144 00	76
77	64 07	27 24	77	37 58	131 04	77	74 08	145 00	77
78	64 48	27 39	78	38 31	131 56	78	74 49	146 00	78
79	65 29	27 54	79	39 04	132 48	79	75 30	147 00	79
80	66 10	28 09	80	39 37	133 40	80	76 11	148 00	80
81	66 51	28 24	81	40 10	134 32	81	76 52	149 00	81
82	67 32	28 39	82	40 43	135 24	82	77 33	150 00	82
83	68 13	28 54	83	41 16	136 16	83	78 14	151 00	83
84	68 54	29 09	84	41 49	137 08	84	78 55	152 00	84
85	69 35	29 24	85	42 22	138 00	85	79 36	153 00	85
86	70 16	29 39	86	42 55	138 52	86	80 17	154 00	86
87	70 57	29 54	87	43 28	139 44	87	80 98	155 00	87
88	71 38	30 09	88	44 01	140 36	88	80 79	156 00	88
89	72 19	30 24	89	44 34	141 28	89	81 60	157 00	89
90	73 00	30 39	90	45 07	142 20	90	82 41	158 00	90
91	73 41	30 54	91	45 40	143 12	91	83 22	159 00	91
92	74 22	31 09	92	46 13	144 04	92	84 03	160 00	92
93	75 03	31 24	93	46 46	144 96	93	84 44	161 00	93
94	75 44	31 39	94	47 19	145 88	94	85 25	162 00	94
95	76 25	31 54	95	47 52	146 80	95	86 06	163 00	95
96	77 06	32 09	96	48 25	147 72	96	86 47	164 00	96
97	77 47	32 24	97	48 58	148 64	97	87 28	165 00	97
98	78 28	32 39	98	49 31	149 56	98	88 09	166 00	98
99	79 09	32 54	99	50 04	150 48	99	88 90	167 00	99
100	79 50	33 09	100	50 37	151 40	100	89 71	168 00	100

5 Rhumb and three quarters is 64 deg. 41 min.



Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	26	64		26	64		26	64	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 00	00 44	difference	00 49	02 05	difference	01 11	02 28	1
2	01 00	00 58	difference	00 58	04 10	difference	02 23	04 56	2
3	02 00	01 12	difference	01 06	06 15	difference	03 14	06 04	3
4	03 00	01 25	difference	01 15	08 20	difference	04 05	09 12	4
5	04 00	02 19	difference	02 44	10 25	difference	05 55	11 41	5
6	05 39	02 63	difference	02 93	12 30	difference	06 68	13 69	6
7	06 00	03 07	difference	03 04	14 35	difference	07 07	15 07	7
8	07 00	03 13	difference	03 17	16 40	difference	08 00	16 00	8
9	08 00	03 19	difference	04 17	18 45	difference	09 01	20 05	9
10	08 58	04 38	difference	04 88	20 50	difference	11 13	22 81	10
11	09 59	04 82	difference	05 36	22 55	difference	12 24	25 09	11
12	10 00	05 25	difference	05 05	24 60	difference	13 35	27 37	12
13	11 00	06 30	difference	06 34	26 65	difference	14 46	29 65	13
14	12 00	06 34	difference	06 38	28 70	difference	15 58	31 94	14
15	13 48	06 58	difference	07 31	30 75	difference	16 69	34 22	15
16	14 38	07 01	difference	07 80	32 80	difference	17 80	36 50	16
17	15 28	07 45	difference	08 00	34 85	difference	18 01	38 78	17
18	16 18	07 89	difference	08 39	35 90	difference	20 03	41 06	18
19	17 08	08 33	difference	09 25	38 95	difference	21 14	43 34	19
20	17 58	08 77	difference	09 75	41 00	difference	22 25	45 62	20
21	18 57	09 20	difference	10 24	43 00	difference	23 36	47 91	21
22	19 57	09 54	difference	10 73	45 11	difference	24 48	50 19	22
23	20 57	10 06	difference	11 21	47 16	difference	25 59	52 47	23
24	21 57	10 52	difference	11 50	49 21	difference	26 70	54 75	24
25	22 47	10 96	difference	12 19	51 26	difference	27 81	57 03	25
26	23 37	11 39	difference	12 68	53 31	difference	28 93	59 31	26
27	24 27	11 83	difference	13 06	55 36	difference	30 04	61 59	27
28	25 17	12 27	difference	13 61	57 41	difference	31 15	63 88	28
29	26 06	12 71	difference	14 14	59 46	difference	32 26	66 16	29
30	26 56	13 15	difference	14 63	61 51	difference	33 38	68 44	30
31	27 46	13 59	difference	15 11	63 50	difference	34 49	70 72	31
32	28 36	14 02	difference	15 50	65 51	difference	35 00	73 00	32
33	29 26	14 46	difference	16 09	67 56	difference	36 11	75 28	33
34	30 16	14 50	difference	16 58	69 57	difference	37 22	77 56	34
35	31 06	15 34	difference	17 06	71 76	difference	38 34	79 81	35
36	32 06	15 78	difference	17 55	73 81	difference	40 05	82 12	36
37	33 06	16 21	difference	18 04	75 86	difference	41 16	84 41	37
38	34 06	16 65	difference	18 53	77 91	difference	42 27	86 69	38
39	35 06	17 09	difference	19 02	79 96	difference	43 39	88 97	39
40	35 56	17 53	difference	19 51	82 01	difference	44 50	91 25	40
41	36 46	17 97	difference	20 00	84 00	difference	45 61	93 53	41
42	37 36	18 40	difference	20 49	85 11	difference	46 73	95 81	42
43	38 26	18 84	difference	20 98	88 16	difference	47 84	98 09	43
44	39 16	19 28	difference	21 47	90 21	difference	48 95	100 37	44
45	40 06	19 72	difference	21 56	92 26	difference	50 06	102 65	45
46	41 06	20 16	difference	22 44	94 31	difference	51 18	104 94	46
47	42 06	20 60	difference	22 53	96 36	difference	52 29	107 22	47
48	43 06	21 04	difference	23 01	98 41	difference	53 40	109 50	48
49	44 06	21 48	difference	23 50	100 46	difference	54 51	111 78	49
50	44 56	21 92	difference	24 39	102 52	difference	55 63	114 06	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	26	64		26	64		26	64	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	45 84	22 35		24 88	104 57		56 74	116 34	51
52	46 074	22 079		25 36	106 062		57 0 65	118 062	52
53	47 0 64	23 0 22		25 185	103 0 67		58 0 66	120 0 91	53
54	48 0 54	23 0 66		26 0 34	110 0 72		60 0 08	123 0 19	54
55	49 45	24 10		27 83	112 77		61 19	125 47	55
56	50 33	24 54		27 31	114 02		62 30	127 75	56
57	51 23	24 0 98		27 180	116 0 87		63 0 41	130 0 03	57
58	52 13	25 0 42		28 0 20	118 0 92		64 0 53	132 0 31	58
59	53 0 03	25 0 86		28 0 78	120 0 97		65 0 64	134 0 58	59
60	53 93	26 30		29 26	123 02		66 76	136 87	60
61	54 83	26 74		29 75	125 07		67 87	139 16	61
62	55 0 73	27 0 17		30 34	127 0 12		68 0 98	141 0 44	62
63	56 0 62	27 0 61		30 0 73	129 0 17		70 0 09	143 0 72	63
64	57 0 52	28 0 05		31 21	131 0 22		71 20	145 0 59	64
65	58 42	28 49		31 70	133 27		72 32	148 27	65
66	59 32	28 93		32 19	135 32		73 43	150 55	66
67	60 22	29 36		32 68	137 37		74 0 54	152 0 83	67
68	61 12	29 80		33 16	139 42		75 0 66	155 11	68
69	62 0 02	30 24		33 0 65	141 47		76 0 77	157 40	69
70	62 52	30 69		34 14	143 52		77 88	159 68	70
71	63 81	31 12		34 63	145 57		78 99	161 96	71
72	64 71	31 56		35 11	147 0 62		80 0 10	164 24	72
73	65 0 61	32 0 00		35 60	149 0 67		81 22	166 0 52	73
74	66 0 51	32 0 44		36 0 09	151 0 72		82 33	168 0 80	74
75	67 41	32 88		36 58	153 77		83 44	171 0 8	75
76	68 31	33 32		37 0 6	155 82		84 56	173 36	76
77	69 21	33 75		37 55	157 0 87		85 0 67	175 0 64	77
78	70 11	34 19		38 0 4	159 0 92		86 78	177 0 93	78
79	71 0 01	34 63		38 53	161 0 97		87 0 89	180 0 21	79
80	71 50	35 07		39 02	164 02		89 01	182 49	80
81	72 80	35 51		39 51	166 08		90 12	184 77	81
82	73 70	36 95		40 0 00	168 13		91 0 23	187 0 05	82
83	74 60	36 38		40 0 49	170 18		92 0 35	189 0 33	83
84	75 50	36 82		40 0 98	172 23		93 46	191 0 61	84
85	76 40	37 26		41 46	174 28		94 57	193 0 90	85
86	77 30	37 70		41 95	176 33		95 63	195 18	86
87	78 20	38 14		42 44	178 38		96 0 79	198 46	87
88	79 10	38 58		42 93	180 43		97 0 91	200 74	88
89	80 0 09	39 0 1		43 41	182 48		99 0 02	203 0 2	89
90	80 59	39 45		43 90	184 52		101 13	205 31	90
91	81 49	39 80		44 39	186 58		101 25	207 58	91
92	82 39	40 33		44 88	189 0 63		102 0 36	209 87	92
93	83 29	40 77		45 36	190 0 68		103 0 47	212 15	93
94	84 19	41 20		45 85	191 0 73		104 0 58	214 43	94
95	85 9	41 64		46 34	194 78		105 69	216 71	95
96	85 59	42 08		46 83	195 83		106 81	219 99	96
97	86 49	42 52		47 31	198 88		107 0 92	222 27	97
98	87 39	43 96		47 80	200 93		109 0 03	224 55	98
99	88 29	43 39		48 29	202 98		110 15	226 84	99
100	89 19	43 84		48 77	205 03		111 26	228 12	100

Numbers	Sines Degrees				Tangents Degrees				Secants Degrees			Numbers
	27		63		27		63		27		63	
	N. pts.	N. pts.	N. pts.		N. pts.	N. pts.	N. pts.		N. pts.	N. pts.	N. pts.	
1	00	89	01	45	00	51	01	06	01	12	02	20
2	01	78	00	91	01	02	03	93	02	24	04	40
3	02	67	01	36	01	53	05	89	03	37	05	61
4	03	57	01	82	02	04	07	85	04	49	08	81
5	04	46	02	27	02	55	09	81	05	61	11	01
6	05	35	02	72	03	06	11	78	06	73	13	22
7	06	24	03	18	03	57	13	74	07	86	15	42
8	07	13	03	63	04	08	15	70	08	98	17	62
9	08	02	04	09	04	59	17	66	10	10	19	82
10	08	92	04	54	05	10	19	63	11	22	22	03
11	09	80	04	99	05	60	21	69	12	34	24	23
12	10	69	05	45	06	11	23	55	13	47	26	43
13	11	58	05	30	06	52	25	51	14	59	28	64
14	12	47	06	36	07	13	27	48	15	71	30	84
15	13	36	06	81	07	64	29	44	16	83	33	04
16	14	26	07	26	08	15	31	40	17	96	35	24
17	15	15	07	72	08	66	33	36	19	08	37	45
18	16	04	08	17	09	17	35	33	20	20	39	65
19	16	53	08	63	09	68	37	29	21	32	41	85
20	17	42	09	08	10	19	39	25	22	45	44	05
21	18	31	09	53	10	70	41	21	23	57	46	26
22	19	20	09	99	11	01	43	18	24	69	48	46
23	20	10	10	44	11	52	45	14	25	81	50	66
24	21	00	10	90	12	23	47	10	26	93	52	87
25	22	28	11	35	12	74	49	06	28	06	55	07
26	23	17	11	80	13	25	51	03	29	18	57	27
27	24	06	12	26	13	76	52	09	30	29	59	47
28	24	55	12	71	14	07	54	95	31	42	61	68
29	25	44	13	17	14	58	56	91	32	55	63	88
30	26	33	13	62	15	29	58	88	33	67	66	08
31	27	22	14	08	15	79	60	84	34	79	68	28
32	28	11	14	53	16	30	62	80	35	91	70	49
33	29	00	14	98	16	81	64	76	37	03	72	69
34	30	29	15	44	17	32	66	73	38	16	74	89
35	31	19	15	89	17	83	68	69	39	28	77	10
36	32	08	16	35	18	34	70	65	40	40	79	30
37	32	57	16	80	19	05	72	61	41	52	81	50
38	33	46	17	25	19	56	74	58	42	64	83	70
39	34	35	17	71	19	87	76	54	43	77	85	91
40	35	24	18	16	20	38	78	50	44	89	88	11
41	36	13	18	62	20	89	80	46	46	01	90	31
42	37	02	19	07	21	40	82	43	47	13	92	51
43	38	51	19	52	21	91	84	39	48	26	94	72
44	39	40	19	98	22	42	86	35	49	38	96	92
45	40	30	20	43	22	93	88	31	50	50	99	12
46	40	19	20	89	23	44	90	28	51	62	101	33
47	41	08	21	34	23	95	92	24	52	74	103	53
48	42	57	21	79	24	46	94	20	53	86	105	73
49	43	46	22	25	24	97	96	16	54	98	107	93
50	44	35	22	70	25	48	98	13	56	12	110	14

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	27	63		27	63		27	63	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	45 45	23 16		25 98	100 09		57 24	112 34	51
52	46 34	23 06		26 49	102 05		58 37	113 54	52
53	47 23	24 07		27 00	104 02		59 49	116 74	53
54	48 12	24 52		27 41	105 58		60 51	118 95	54
55	49 01	24 97		28 02	107 94		61 73	121 15	55
56	49 50	25 43		28 53	109 90		62 86	123 35	56
57	50 79	26 08		29 04	111 86		63 08	125 55	57
58	51 68	26 34		29 55	113 83		64 10	127 76	58
59	52 58	25 79		30 05	115 79		65 22	129 96	59
60	53 46	27 24		30 57	117 76		67 34	132 16	60
61	54 35	27 70		31 08	119 72		68 47	134 36	61
62	55 25	28 15		31 59	121 68		69 59	136 57	62
63	56 14	28 61		32 10	123 65		70 71	138 77	63
64	57 03	29 06		32 50	125 61		71 83	140 97	64
65	57 52	29 51		33 11	127 57		72 96	143 18	65
66	58 81	29 97		33 52	129 53		74 08	145 38	66
67	59 70	30 42		34 13	131 50		75 20	147 58	67
68	60 59	30 88		34 54	133 45		76 32	149 78	68
69	61 48	31 33		35 15	135 42		77 45	151 99	69
70	62 37	31 78		35 57	137 38		78 56	154 19	70
71	63 27	32 24		36 17	139 35		79 69	156 39	71
72	64 16	32 69		36 58	141 31		80 81	158 60	72
73	65 05	33 15		37 19	143 27		81 93	160 80	73
74	65 54	33 60		37 50	145 23		83 06	163 00	74
75	66 43	34 05		38 21	147 20		84 18	165 20	75
76	67 32	34 51		38 72	149 16		85 29	167 41	76
77	68 21	35 36		39 23	151 12		86 42	169 61	77
78	69 10	35 42		39 74	153 08		87 55	171 81	78
79	70 00	35 87		40 25	155 05		88 67	174 01	79
80	71 28	35 32		40 76	157 01		89 79	176 22	80
81	72 18	36 78		41 27	158 97		90 91	178 42	81
82	73 07	37 23		41 78	160 93		92 03	180 62	82
83	74 05	37 69		42 29	162 90		93 16	182 83	83
84	74 54	38 14		42 79	164 86		94 28	185 03	84
85	75 43	38 60		43 30	166 82		95 40	187 23	85
86	76 32	39 05		43 81	168 78		96 52	189 43	86
87	77 21	39 50		44 32	170 75		97 64	191 64	87
88	78 10	40 41		44 83	172 71		98 77	193 84	88
89	79 00	40 86		45 34	174 67		99 89	196 04	89
90	80 19	40 85		45 85	176 63		101 01	198 24	90
91	81 08	41 31		46 36	178 60		102 13	200 45	91
92	81 99	41 75		46 87	180 56		103 26	202 65	92
93	82 77	42 22		47 38	182 52		104 38	204 85	93
94	83 56	42 67		47 89	184 48		105 50	207 05	94
95	84 65	43 13		48 40	186 45		106 62	209 26	95
96	85 54	43 58		48 91	188 41		107 70	211 46	96
97	86 43	44 04		49 42	190 37		108 88	213 66	97
98	87 32	44 50		49 93	192 33		110 00	215 86	98
99	88 21	44 04		50 44	194 30		111 12	218 07	99
100	89 10	45 40		50 95	196 26		112 23	220 27	100

5 Rhumb and a half is 61 deg. 52 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	28	62		28	62		28	62	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00	00	1	00	00	1	01	02	1
2	01	00	2	01	01	2	02	03	2
3	02	01	3	02	02	3	03	04	3
4	03	01	4	03	03	4	04	05	4
5	04	02	5	04	04	5	05	06	5
6	05	02	6	05	05	6	06	07	6
7	06	03	7	06	06	7	07	08	7
8	07	03	8	07	07	8	08	09	8
9	08	04	9	08	08	9	09	10	9
10	09	04	10	09	09	10	10	11	10
11	10	05	11	10	10	11	11	12	11
12	11	05	12	11	11	12	12	13	12
13	12	06	13	12	12	13	13	14	13
14	13	06	14	13	13	14	14	15	14
15	14	07	15	14	14	15	15	16	15
16	15	07	16	15	15	16	16	17	16
17	16	08	17	16	16	17	17	18	17
18	17	08	18	17	17	18	18	19	18
19	18	09	19	18	18	19	19	20	19
20	19	09	20	19	19	20	20	21	20
21	20	10	21	20	20	21	21	22	21
22	21	10	22	21	21	22	22	23	22
23	22	11	23	22	22	23	23	24	23
24	23	11	24	23	23	24	24	25	24
25	24	12	25	24	24	25	25	26	25
26	25	12	26	25	25	26	26	27	26
27	26	13	27	26	26	27	27	28	27
28	27	13	28	27	27	28	28	29	28
29	28	14	29	28	28	29	29	30	29
30	29	14	30	29	29	30	30	31	30
31	30	15	31	30	30	31	31	32	31
32	31	15	32	31	31	32	32	33	32
33	32	16	33	32	32	33	33	34	33
34	33	16	34	33	33	34	34	35	34
35	34	17	35	34	34	35	35	36	35
36	35	17	36	35	35	36	36	37	36
37	36	18	37	36	36	37	37	38	37
38	37	18	38	37	37	38	38	39	38
39	38	19	39	38	38	39	39	40	39
40	39	19	40	39	39	40	40	41	40
41	40	20	41	40	40	41	41	42	41
42	41	20	42	41	41	42	42	43	42
43	42	21	43	42	42	43	43	44	43
44	43	21	44	43	43	44	44	45	44
45	44	22	45	44	44	45	45	46	45
46	45	22	46	45	45	46	46	47	46
47	46	23	47	46	46	47	47	48	47
48	47	23	48	47	47	48	48	49	48
49	48	24	49	48	48	49	49	50	49
50	49	24	50	49	49	50	50	51	50

2 Rhumb and a half is 28 deg. 8 min.



2 Rhumb and a half is 28 deg. 8 min.

Numbers	Sines Degrees			Tangents Degrees			Secants. Degrees.		Numbers
	28	62		28	62		28	62	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
15	45 03	23 54		27 13	55 92		57 77	108 65	51
16	45 16	24 01		27 26	57 40		58 00	110 76	52
17	45 30	24 08		27 39	59 28		59 03	112 89	53
18	45 43	24 15		27 52	61 16		60 17	115 02	54
19	45 56	24 22		28 05	63 04		61 30	117 15	55
20	46 09	24 29		28 18	64 52		62 29	119 28	56
21	46 22	24 36		28 31	66 40		63 43	121 42	57
22	46 35	24 43		28 44	68 28		64 55	123 54	58
23	46 48	24 50		28 57	70 16		65 06	125 67	59
24	47 01	24 57		29 10	72 04		66 18	127 80	60
25	47 14	25 04		29 23	73 52		67 29	129 93	61
26	47 27	25 11		29 36	75 40		68 41	132 06	62
27	47 40	25 18		29 49	77 28		69 53	134 19	63
28	47 53	25 25		30 02	79 16		71 05	136 32	64
29	48 06	25 32		30 15	81 04		72 18	138 45	65
30	48 19	25 39		30 28	82 52		73 29	140 58	66
31	48 32	25 46		30 41	84 40		74 41	142 71	67
32	48 45	25 53		30 54	86 28		75 53	144 84	68
33	48 58	26 00		31 07	88 16		77 05	146 97	69
34	49 11	26 07		31 20	90 04		78 17	149 10	70
35	49 24	26 14		31 33	91 52		79 28	151 23	71
36	49 37	26 21		31 46	93 40		80 40	153 36	72
37	49 50	26 28		31 59	95 28		81 52	155 49	73
38	50 03	26 35		32 12	97 16		83 04	157 62	74
39	50 16	26 42		32 25	99 04		84 16	159 75	75
40	50 29	26 49		32 38	100 52		85 28	161 88	76
41	50 42	26 56		32 51	102 40		86 40	164 01	77
42	50 55	27 03		33 04	104 28		87 52	166 14	78
43	51 08	27 10		33 17	106 16		89 04	168 27	79
44	51 21	27 17		33 30	108 04		90 16	170 40	80
45	51 34	27 24		33 43	109 52		91 28	172 53	81
46	51 47	27 31		33 56	111 40		92 40	174 66	82
47	51 60	27 38		34 09	113 28		93 52	176 79	83
48	51 73	27 45		34 22	115 16		95 04	178 92	84
49	51 86	27 52		34 35	117 04		96 16	181 05	85
50	51 99	27 59		34 48	118 52		97 28	183 18	86
51	52 12	28 06		35 01	120 40		98 40	185 31	87
52	52 25	28 13		35 14	122 28		99 52	187 44	88
53	52 38	28 20		35 27	124 16		100 04	189 57	89
54	52 51	28 27		35 40	126 04		101 16	191 70	90
55	53 04	28 34		35 53	127 52		102 28	193 83	91
56	53 17	28 41		36 06	129 40		103 40	195 96	92
57	53 30	28 48		36 19	131 28		104 52	198 09	93
58	53 43	28 55		36 32	133 16		106 04	200 22	94
59	53 56	29 02		36 45	135 04		107 16	202 35	95
60	54 09	29 09		36 58	136 52		108 28	204 48	96
61	54 22	29 16		37 11	138 40		109 40	206 61	97
62	54 35	29 23		37 24	140 28		110 52	208 74	98
63	54 48	29 30		37 37	142 16		111 04	210 87	99
64	54 61	29 37		37 50	144 04		112 16	213 00	100
65	54 74	29 44		38 03	145 52				
66	54 87	29 51		38 16	147 40				
67	55 00	30 00		38 29	149 28				
68	55 13	30 07		38 42	151 16				
69	55 26	30 14		38 55	153 04				
70	55 39	30 21		39 08	154 92				
71	55 52	30 28		39 21	156 80				
72	56 05	30 35		39 34	158 68				
73	56 18	30 42		39 47	160 56				
74	56 31	30 49		40 00	162 44				
75	56 44	30 56		40 13	164 32				
76	56 57	31 03		40 26	166 20				
77	57 10	31 10		40 39	168 08				
78	57 23	31 17		40 52	169 96				
79	57 36	31 24		41 05	171 84				
80	57 49	31 31		41 18	173 72				
81	58 02	31 38		41 31	175 60				
82	58 15	31 45		41 44	177 48				
83	58 28	31 52		41 57	179 36				
84	58 41	32 00		42 10	181 24				
85	58 54	32 07		42 23	183 12				
86	59 07	32 14		42 36	185 00				
87	59 20	32 21		42 49	186 88				
88	59 33	32 28		43 02	188 76				
89	59 46	32 35		43 15	190 64				
90	59 59	32 42		43 28	192 52				
91	60 12	32 49		43 41	194 40				
92	60 25	32 56		43 54	196 28				
93	60 38	33 03		44 07	198 16				
94	60 51	33 10		44 20	200 04				
95	61 04	33 17		44 33	201 92				
96	61 17	33 24		44 46	203 80				
97	61 30	33 31		44 59	205 68				
98	61 43	33 38		45 12	207 56				
99	61 56	33 45		45 25	209 44				
100	62 09	33 52		45 38	211 32				

5 Rhumb and a half is 61 deg. 52 min.



Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	29	61		29	61		29	61	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 87	00 48	difference	00 55	01 80	14	01 44	02 06	1
2	01 17	00 57	difference	01 11	03 61	15	02 19	02 13	2
3	02 02	01 45	difference	01 66	05 41	16	03 43	03 19	3
4	03 50	01 54	difference	02 22	07 22	17	04 57	04 25	4
5	04 37	02 42	difference	02 77	09 02	18	05 72	10 31	5
6	05 25	02 51	difference	03 33	10 82	19	06 86	12 38	6
7	06 12	03 03	difference	03 88	12 63	20	08 00	14 44	7
8	07 00	03 12	difference	04 43	14 43	21	09 00	16 50	8
9	07 47	04 36	difference	04 59	16 24	22	10 29	18 56	9
10	08 35	04 85	difference	05 54	18 04	23	11 43	20 63	10
11	09 22	05 33	difference	06 19	19 84	24	12 57	22 69	11
12	10 10	05 42	difference	06 65	21 65	25	13 00	24 72	12
13	11 37	06 30	difference	07 21	23 45	26	14 06	26 81	13
14	12 25	06 39	difference	07 76	25 25	27	15 00	28 88	14
15	13 12	07 27	difference	08 31	27 06	28	17 15	30 94	15
16	14 00	07 75	difference	08 87	28 86	29	18 29	33 00	16
17	14 47	08 24	difference	09 42	30 67	30	19 43	35 06	17
18	15 35	08 73	difference	09 58	32 47	31	20 57	37 13	18
19	16 22	09 21	difference	10 53	34 28	32	21 72	39 19	19
20	17 49	09 70	difference	11 09	36 08	33	22 87	41 25	20
21	18 35	10 18	difference	11 64	37 89	34	24 01	43 31	21
22	19 24	10 67	difference	12 20	39 69	35	25 15	45 38	22
23	20 11	11 15	difference	12 75	41 49	36	26 30	47 44	23
24	20 59	11 64	difference	13 31	43 30	37	27 44	49 50	24
25	21 46	12 12	difference	13 86	45 10	38	28 58	51 56	25
26	22 34	12 61	difference	14 42	46 91	39	29 73	53 63	26
27	23 21	13 09	difference	14 97	48 71	40	30 87	55 69	27
28	24 49	13 57	difference	15 52	50 51	41	32 01	57 75	28
29	25 36	14 06	difference	16 08	52 32	42	33 15	59 81	29
30	26 24	14 54	difference	16 63	54 12	43	34 30	61 88	30
31	27 11	15 03	difference	17 18	55 92	44	35 44	63 94	31
32	28 09	15 51	difference	17 74	57 73	45	36 58	66 00	32
33	29 06	16 00	difference	18 29	59 53	46	37 73	68 07	33
34	29 54	16 48	difference	18 85	61 33	47	38 87	70 13	34
35	30 71	16 97	difference	19 40	63 14	48	40 01	72 19	35
36	31 49	17 45	difference	19 96	64 94	49	41 15	74 25	36
37	32 36	17 54	difference	20 51	66 75	50	42 30	76 32	37
38	33 24	18 42	difference	21 06	68 55	51	43 44	78 38	38
39	34 11	18 51	difference	21 62	70 35	52	44 58	80 44	39
40	34 98	19 39	difference	22 17	72 16	53	45 73	82 51	40
41	35 85	19 88	difference	22 73	73 96	54	46 88	84 57	41
42	36 73	20 36	difference	23 28	75 77	55	48 02	86 63	42
43	37 60	20 85	difference	23 84	77 57	56	49 16	88 69	43
44	38 48	21 33	difference	24 39	79 38	57	50 31	90 75	44
45	39 35	21 82	difference	24 95	81 18	58	51 45	92 81	45
46	40 23	22 30	difference	25 50	82 99	59	52 59	94 88	46
47	41 10	22 79	difference	26 06	84 79	60	53 74	96 94	47
48	41 57	23 27	difference	26 61	86 60	61	54 88	99 00	48
49	42 45	23 75	difference	27 17	88 40	62	56 02	101 07	49
50	43 33	24 24	difference	27 72	90 20	63	57 17	103 13	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	29	61		29	61		29	61	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	44 66	24 73		28 27	92 01		58 32	105 20	51
52	45 48	25 02		29 48	93 08		59 04	107 26	52
53	46 35	25 07		29 38	95 01		60 06	109 32	53
54	47 23	25 18		29 29	97 42		61 07	111 39	54
55	48 10	25 67		30 49	99 22		62 09	113 45	55
56	48 58	27 15		31 04	101 03		64 03	115 51	56
57	49 45	27 04		31 50	102 43		65 07	117 57	57
58	50 32	29 12		32 15	104 44		66 32	119 54	58
59	51 19	29 01		32 51	106 44		67 45	121 70	59
60	52 48	29 09		33 26	108 24		68 60	123 76	60
61	53 35	29 57		33 82	110 05		69 75	125 82	61
62	54 23	30 06		34 37	111 05		70 08	127 89	62
63	55 10	30 54		34 53	113 06		72 03	129 55	63
64	55 58	31 03		35 48	115 46		73 17	132 01	64
65	56 44	31 51		36 04	117 26		74 32	134 07	65
66	57 32	32 00		36 59	119 07		75 45	136 14	66
67	58 19	32 43		37 15	120 87		76 06	138 20	67
68	59 07	32 97		37 50	122 68		77 15	140 26	68
69	60 34	33 45		38 25	124 48		78 09	142 32	69
70	61 22	33 54		38 80	126 28		80 03	144 39	70
71	62 09	34 42		39 36	128 09		81 18	146 45	71
72	62 57	34 51		39 51	129 89		82 03	148 51	72
73	63 44	35 39		40 47	131 70		83 07	150 57	73
74	64 31	35 88		41 02	133 50		84 01	152 64	74
75	65 18	36 36		41 58	135 30		85 76	154 70	75
76	66 05	36 85		42 13	137 11		86 50	156 76	76
77	66 53	37 33		42 59	138 51		88 04	158 82	77
78	67 40	37 82		43 24	140 72		89 18	160 89	78
79	68 27	38 30		43 79	142 52		90 33	162 95	79
80	69 14	38 78		44 34	144 30		91 47	165 01	80
81	70 01	39 27		44 90	146 13		92 61	167 07	81
82	70 48	39 75		45 45	147 53		93 07	169 14	82
83	71 35	40 24		46 01	149 34		94 20	171 20	83
84	72 22	40 73		46 56	151 14		95 04	173 26	84
85	73 09	41 21		47 12	153 34		97 18	175 32	85
86	73 56	41 70		47 67	155 15		98 33	177 39	86
87	74 43	42 18		48 23	156 55		99 47	179 45	87
88	75 30	42 67		48 78	158 36		100 61	181 51	88
89	76 17	43 15		49 34	160 16		101 76	183 57	89
90	77 04	43 63		49 89	162 36		102 50	185 64	90
91	77 51	44 12		50 45	164 17		104 04	187 70	91
92	78 38	44 61		51 00	165 57		105 18	189 76	92
93	79 25	45 09		51 55	167 38		106 33	191 82	93
94	80 12	45 57		52 11	169 58		107 47	193 89	94
95	81 00	46 06		52 66	171 38		108 61	195 95	95
96	81 47	46 54		53 22	173 19		109 76	198 01	96
97	82 34	47 03		53 77	174 99		110 50	200 07	97
98	83 21	47 51		54 33	176 80		112 05	202 14	98
99	84 08	48 00		54 88	178 60		113 19	204 21	99
100	84 45	48 48		55 43	180 40		114 34	206 27	100

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	30	60		30	60		30	60	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 87	00 50	1	00 58	01 73	1	01 15	02 00	1
2	01 17	01 16	2	01 15	03 45	2	02 31	04 00	2
3	02 00	01 56	3	01 57	05 20	3	03 46	05 00	3
4	03 45	02 00	4	02 31	06 01	4	05 02	06 00	4
5	04 33	02 50	5	02 89	06 56	5	06 57	10 00	5
6	05 20	03 00	6	03 45	10 39	6	08 03	12 00	6
7	06 06	03 50	7	04 04	12 12	7	09 08	14 00	7
8	06 53	04 12	8	04 16	13 06	8	09 24	16 00	8
9	07 39	04 50	9	05 20	15 59	9	10 39	18 00	9
10	08 26	05 00	10	05 77	17 32	10	11 55	20 00	10
11	09 13	05 50	11	06 35	19 05	11	12 70	22 00	11
12	10 01	06 00	12	06 53	20 08	12	13 06	24 00	12
13	11 26	06 50	13	07 51	22 52	13	15 01	26 00	13
14	12 12	07 00	14	08 08	24 25	14	16 16	28 00	14
15	12 99	07 50	15	08 66	25 08	15	17 32	30 00	15
16	13 86	08 00	16	09 24	27 11	16	18 48	32 00	16
17	14 72	08 50	17	09 51	29 44	17	19 53	34 00	17
18	15 59	09 40	18	10 39	31 29	18	20 58	36 00	18
19	16 45	09 50	19	10 57	32 19	19	21 54	38 00	19
20	17 32	10 00	20	11 55	34 04	20	23 09	40 00	20
21	18 19	10 50	21	12 12	36 37	21	24 25	42 00	21
22	19 05	11 00	22	12 50	38 10	22	25 40	44 00	22
23	19 52	11 50	23	13 28	39 54	23	26 56	46 00	23
24	20 39	12 00	24	13 48	41 57	24	27 71	48 00	24
25	21 26	12 50	25	14 43	43 30	25	28 87	50 00	25
26	22 13	13 00	26	15 01	45 03	26	30 02	52 00	26
27	23 00	13 50	27	15 59	46 56	27	31 17	54 00	27
28	23 47	14 00	28	16 16	48 10	28	32 33	56 00	28
29	24 34	14 50	29	16 54	50 23	29	33 49	58 00	29
30	25 21	15 00	30	17 32	51 56	30	34 64	60 00	30
31	26 08	15 50	31	17 50	53 09	31	35 79	62 00	31
32	26 55	16 00	32	18 47	55 42	32	36 95	64 00	32
33	27 42	16 50	33	19 05	57 15	33	38 10	66 00	33
34	28 29	17 00	34	19 23	58 28	34	39 26	68 00	34
35	29 16	17 50	35	20 21	60 02	35	40 41	70 00	35
36	30 03	18 00	36	20 78	62 35	36	41 57	72 00	36
37	30 50	18 50	37	21 35	64 08	37	42 72	74 00	37
38	31 37	19 00	38	21 54	65 41	38	43 88	76 00	38
39	32 24	19 50	39	22 52	67 55	39	45 03	78 00	39
40	33 11	20 00	40	23 09	69 28	40	46 19	80 00	40
41	34 00	20 50	41	23 67	71 01	41	47 34	82 00	41
42	34 47	21 00	42	24 25	72 14	42	48 50	84 00	42
43	35 34	21 50	43	24 82	74 47	43	49 65	86 00	43
44	36 21	22 00	44	25 40	76 21	44	50 80	88 00	44
45	37 08	22 50	45	25 98	77 54	45	51 96	90 00	45
46	37 55	23 00	46	26 56	79 67	46	53 11	92 00	46
47	38 42	23 50	47	27 13	81 40	47	54 27	94 00	47
48	39 29	24 00	48	27 71	83 13	48	55 42	96 00	48
49	40 16	24 50	49	28 29	84 87	49	56 58	98 00	49
50	41 03	25 00	50	28 87	86 60	50	57 73	100 00	50

Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	30	60	30	60	30	60	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
51	44 17	25 50	29 44	88 33	59 87	102 00	51
52	45 03	25 00	30 00	90 00	60 00	101 00	52
53	45 49	25 00	30 30	91 30	61 20	100 00	53
54	46 35	27 00	31 18	93 33	62 35	109 00	54
55	47 21	27 50	31 75	95 25	63 51	110 00	55
56	48 07	29 00	32 33	96 99	64 65	112 00	56
57	48 53	29 50	32 19	98 72	65 08	114 00	57
58	49 39	29 00	33 43	100 45	65 57	116 00	58
59	50 25	29 50	34 06	102 19	66 13	118 00	59
60	51 11	30 00	34 64	103 52	67 29	120 00	60
61	52 00	30 50	35 22	105 65	70 44	122 00	61
62	53 00	31 00	35 79	107 38	71 50	124 00	62
63	54 00	31 50	36 37	109 11	72 55	126 00	63
64	55 00	32 40	36 95	110 85	73 58	128 00	64
65	56 00	32 50	37 53	112 58	75 06	130 00	65
66	57 16	33 00	38 10	114 31	76 21	132 00	66
67	58 02	33 50	38 68	116 04	77 35	134 00	67
68	58 89	34 00	39 26	117 77	78 52	136 00	68
69	59 75	34 50	39 83	119 51	79 68	138 00	69
70	60 62	35 00	40 41	121 24	80 83	140 00	70
71	61 49	35 50	40 99	122 57	81 99	142 00	71
72	62 35	36 00	41 57	124 30	83 14	144 00	72
73	63 22	36 50	42 14	126 03	84 29	146 00	73
74	64 08	37 00	42 72	127 17	85 44	148 00	74
75	64 95	37 50	43 30	129 00	86 60	150 00	75
76	65 82	38 00	43 87	131 63	87 75	152 00	76
77	66 68	38 50	44 45	133 36	88 91	154 00	77
78	67 55	39 00	45 03	135 09	90 06	156 00	78
79	68 41	39 50	45 61	136 83	91 22	158 00	79
80	69 28	40 00	46 19	138 57	92 38	160 00	80
81	70 15	40 50	46 76	140 29	93 53	162 00	81
82	70 51	41 00	47 34	142 02	94 68	164 00	82
83	71 38	41 50	47 52	143 75	95 84	166 00	83
84	72 24	42 00	48 50	145 38	96 99	168 00	84
85	73 11	42 50	49 07	147 22	98 14	170 00	85
86	74 00	43 00	49 65	148 95	99 30	172 00	86
87	75 34	43 50	50 23	150 60	100 46	174 00	87
88	76 21	44 00	50 82	152 31	101 61	176 00	88
89	77 07	44 50	51 39	153 14	102 76	178 00	89
90	77 54	45 00	51 56	155 89	103 52	180 00	90
91	78 41	45 50	52 54	157 61	105 07	182 00	91
92	79 27	46 00	53 11	159 34	106 23	184 00	92
93	80 14	46 50	53 69	161 07	107 38	186 00	93
94	81 00	47 00	54 27	162 80	108 54	188 00	94
95	82 27	47 50	54 84	164 54	109 69	190 00	95
96	83 14	48 00	55 42	166 27	110 85	192 00	96
97	84 00	48 50	56 00	168 00	112 00	194 00	97
98	84 47	49 00	56 58	169 73	113 15	196 00	98
99	85 34	49 50	57 15	171 46	114 31	198 00	99
100	86 21	50 00	57 74	173 20	115 47	200 00	100

5 Rhumb and a quarter is 59 deg. 4 min.

Numbers	Sines Degrees		Tangents Degrees	Secants Degrees	Numbers
	31	59	31	59	
1	N. pts.	N. pts.	N. pts.	N. pts.	1
2	00 00	00 00	00 00	00 00	2
3	01 01	01 01	01 01	01 01	3
4	02 02	02 02	02 02	02 02	4
5	03 03	03 03	03 03	03 03	5
6	04 04	04 04	04 04	04 04	6
7	05 05	05 05	05 05	05 05	7
8	06 06	06 06	06 06	06 06	8
9	07 07	07 07	07 07	07 07	9
10	08 08	08 08	08 08	08 08	10
11	09 09	09 09	09 09	09 09	11
12	10 10	10 10	10 10	10 10	12
13	11 11	11 11	11 11	11 11	13
14	12 12	12 12	12 12	12 12	14
15	13 13	13 13	13 13	13 13	15
16	14 14	14 14	14 14	14 14	16
17	15 15	15 15	15 15	15 15	17
18	16 16	16 16	16 16	16 16	18
19	17 17	17 17	17 17	17 17	19
20	18 18	18 18	18 18	18 18	20
21	19 19	19 19	19 19	19 19	21
22	20 20	20 20	20 20	20 20	22
23	21 21	21 21	21 21	21 21	23
24	22 22	22 22	22 22	22 22	24
25	23 23	23 23	23 23	23 23	25
26	24 24	24 24	24 24	24 24	26
27	25 25	25 25	25 25	25 25	27
28	26 26	26 26	26 26	26 26	28
29	27 27	27 27	27 27	27 27	29
30	28 28	28 28	28 28	28 28	30
31	29 29	29 29	29 29	29 29	31
32	30 30	30 30	30 30	30 30	32
33	31 31	31 31	31 31	31 31	33
34	32 32	32 32	32 32	32 32	34
35	33 33	33 33	33 33	33 33	35
36	34 34	34 34	34 34	34 34	36
37	35 35	35 35	35 35	35 35	37
38	36 36	36 36	36 36	36 36	38
39	37 37	37 37	37 37	37 37	39
40	38 38	38 38	38 38	38 38	40
41	39 39	39 39	39 39	39 39	41
42	40 40	40 40	40 40	40 40	42
43	41 41	41 41	41 41	41 41	43
44	42 42	42 42	42 42	42 42	44
45	43 43	43 43	43 43	43 43	45
46	44 44	44 44	44 44	44 44	46
47	45 45	45 45	45 45	45 45	47
48	46 46	46 46	46 46	46 46	48
49	47 47	47 47	47 47	47 47	49
50	48 48	48 48	48 48	48 48	50

2 Rhumb and three quarters is 30 deg. 56 min.



2 Rhumb and three quarters is 30 deg. 56 min

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	31	59		31	59		31	59	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	43 71	25 27		30 64	84 88		59 50	99 02	51
52	44 00	25 07		31 24	86 54		60 00	100 00	52
53	45 04	24 40		31 54	88 24		61 00	102 01	53
54	46 09	24 11		32 24	89 54		62 00	104 02	54
55	47 14	23 43		33 04	91 54		63 00	106 03	55
56	48 00	23 14		33 34	93 20		64 16	108 04	56
57	48 56	22 45		34 04	94 46		65 33	110 05	57
58	49 51	22 16		34 34	96 12		66 50	112 06	58
59	50 57	21 47		35 04	97 38		67 07	114 07	59
60	51 43	21 18		35 34	99 04		68 00	116 08	60
61	52 29	20 49		36 04	101 30		69 00	118 09	61
62	53 14	20 20		36 34	103 56		70 00	120 10	62
63	54 00	19 51		37 04	106 12		71 16	122 11	63
64	54 46	19 22		37 34	108 38		72 00	124 12	64
65	55 31	18 53		38 04	110 64		73 00	126 13	65
66	56 17	18 24		38 34	112 90		74 00	128 14	66
67	57 02	17 55		39 04	115 16		75 00	130 15	67
68	57 48	17 26		40 00	117 42		76 00	132 16	68
69	58 33	16 57		40 30	119 68		77 00	134 17	69
70	59 19	16 28		41 00	121 94		78 00	136 18	70
71	60 04	15 59		41 30	124 20		79 00	138 19	71
72	60 50	15 30		42 00	126 46		80 00	140 20	72
73	61 35	15 01		42 30	129 02		81 00	142 21	73
74	62 21	14 32		43 00	131 28		82 03	144 22	74
75	63 06	14 03		43 30	133 54		83 00	146 23	75
76	63 52	13 34		44 00	136 20		84 00	148 24	76
77	64 37	13 05		44 30	138 46		85 16	150 25	77
78	65 23	12 36		45 00	141 02		86 33	152 26	78
79	66 08	12 07		45 30	143 28		87 50	154 27	79
80	66 54	11 38		46 00	145 54		88 66	156 28	80
81	67 39	11 09		46 30	148 20		89 00	158 29	81
82	68 25	10 40		47 00	150 46		90 00	160 30	82
83	69 10	10 11		47 30	153 02		91 00	162 31	83
84	70 00	9 42		48 00	155 28		92 00	164 32	84
85	70 46	9 13		48 30	157 54		93 00	166 33	85
86	71 31	8 44		49 00	160 20		94 00	168 34	86
87	72 17	8 15		49 30	162 46		95 00	170 35	87
88	73 02	7 46		50 00	165 02		96 00	172 36	88
89	73 48	7 17		50 30	167 28		97 00	174 37	89
90	74 33	6 48		51 00	169 54		98 00	176 38	90
91	75 19	6 19		51 30	172 20		99 00	178 39	91
92	76 04	5 50		52 00	174 46		100 33	180 40	92
93	76 50	5 21		52 30	177 02		101 00	182 41	93
94	77 35	4 52		53 00	179 28		102 00	184 42	94
95	78 21	4 23		53 30	181 54		103 00	186 43	95
96	79 06	3 54		54 00	184 20		104 00	188 44	96
97	79 52	3 25		54 30	186 46		105 00	190 45	97
98	80 37	2 56		55 00	189 02		106 16	192 46	98
99	81 23	2 27		55 30	191 28		107 00	194 47	99
100	82 08	1 58		56 00	193 54		108 00	196 48	100

5 Rhumb and a quarter is 50 deg. 4 min.



Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	32	58		32	58		32	58	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 00	00 00	1	00 00	01 00	1	01 18	01 39	1
2	01 05	01 05	2	01 05	02 00	2	02 36	02 57	2
3	02 10	02 10	3	02 10	03 00	3	03 54	03 56	3
4	03 15	03 15	4	03 15	04 00	4	04 42	04 55	4
5	04 20	04 20	5	04 20	05 00	5	05 30	05 44	5
6	05 25	05 25	6	05 25	06 00	6	06 08	06 32	6
7	06 30	06 30	7	06 30	07 00	7	07 08	07 21	7
8	07 35	07 35	8	07 35	08 00	8	08 08	08 10	8
9	08 40	08 40	9	08 40	09 00	9	09 11	09 16	9
10	09 45	09 45	10	09 45	10 00	10	10 14	10 18	10
11	10 50	10 50	11	10 50	11 00	11	11 17	11 20	11
12	11 55	11 55	12	11 55	12 00	12	12 20	12 26	12
13	12 59	12 59	13	12 59	13 00	13	13 23	13 33	13
14	13 54	13 54	14	13 54	14 00	14	14 26	14 42	14
15	14 58	14 58	15	14 58	15 00	15	15 29	15 51	15
16	15 52	15 52	16	15 52	16 00	16	16 31	16 58	16
17	16 46	16 46	17	16 46	17 00	17	17 33	17 65	17
18	17 40	17 40	18	17 40	18 00	18	18 35	18 72	18
19	18 34	18 34	19	18 34	19 00	19	19 37	19 85	19
20	19 28	19 28	20	19 28	20 00	20	20 39	20 92	20
21	20 22	20 22	21	20 22	21 00	21	21 41	21 100	21
22	21 16	21 16	22	21 16	22 00	22	22 43	22 112	22
23	22 10	22 10	23	22 10	23 00	23	23 45	23 124	23
24	23 04	23 04	24	23 04	24 00	24	24 47	24 136	24
25	23 58	23 58	25	23 58	25 00	25	25 49	25 148	25
26	24 52	24 52	26	24 52	26 00	26	26 51	26 160	26
27	25 46	25 46	27	25 46	27 00	27	27 53	27 172	27
28	26 40	26 40	28	26 40	28 00	28	28 55	28 184	28
29	27 34	27 34	29	27 34	29 00	29	29 57	29 196	29
30	28 28	28 28	30	28 28	30 00	30	30 59	30 208	30
31	29 22	29 22	31	29 22	31 00	31	31 61	31 220	31
32	30 16	30 16	32	30 16	32 00	32	32 63	32 232	32
33	31 10	31 10	33	31 10	33 00	33	33 65	33 244	33
34	32 04	32 04	34	32 04	34 00	34	34 67	34 256	34
35	32 58	32 58	35	32 58	35 00	35	35 69	35 268	35
36	33 52	33 52	36	33 52	36 00	36	36 71	36 280	36
37	34 46	34 46	37	34 46	37 00	37	37 73	37 292	37
38	35 40	35 40	38	35 40	38 00	38	38 75	38 304	38
39	36 34	36 34	39	36 34	39 00	39	39 77	39 316	39
40	37 28	37 28	40	37 28	40 00	40	40 79	40 328	40
41	38 22	38 22	41	38 22	41 00	41	41 81	41 340	41
42	39 16	39 16	42	39 16	42 00	42	42 83	42 352	42
43	40 10	40 10	43	40 10	43 00	43	43 85	43 364	43
44	41 04	41 04	44	41 04	44 00	44	44 87	44 376	44
45	41 58	41 58	45	41 58	45 00	45	45 89	45 388	45
46	42 52	42 52	46	42 52	46 00	46	46 91	46 400	46
47	43 46	43 46	47	43 46	47 00	47	47 93	47 412	47
48	44 40	44 40	48	44 40	48 00	48	48 95	48 424	48
49	45 34	45 34	49	45 34	49 00	49	49 97	49 436	49
50	46 28	46 28	50	46 28	50 00	50	50 99	50 448	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	32	58		32	58		32	58	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	43 25	27 03		31 87	81 62		60 13	96 24	51
52	44 10	27 05		32 49	83 22		61 31	98 12	52
53	44 55	27 09		33 12	84 32		62 49	100 01	53
54	45 39	27 12		33 57	86 42		63 67	101 50	54
55	46 24	29 15		34 37	88 02		64 85	103 78	55
56	47 09	29 18		35 22	89 62		65 03	105 67	56
57	47 54	30 21		36 07	91 22		66 21	107 56	57
58	48 39	30 24		36 52	92 82		67 39	109 44	58
59	49 24	31 27		37 37	94 42		68 57	111 33	59
60	50 09	31 30		38 22	96 02		69 75	113 22	60
61	50 54	32 33		39 07	97 62		70 93	115 11	61
62	51 39	32 36		39 52	99 22		71 11	116 59	62
63	52 24	33 39		40 37	100 82		72 29	118 48	63
64	53 09	33 42		41 22	102 42		73 47	120 37	64
65	53 54	34 45		42 07	104 02		74 65	122 26	65
66	54 39	34 48		42 52	105 62		75 82	124 15	66
67	55 24	35 51		43 37	107 22		76 00	126 04	67
68	56 09	36 04		44 22	108 82		77 18	127 53	68
69	56 54	36 07		45 07	110 42		78 36	129 42	69
70	57 39	37 09		45 52	112 02		79 54	131 31	70
71	58 24	37 12		46 37	113 62		80 72	133 20	71
72	59 09	38 15		47 22	115 22		81 90	135 09	72
73	59 54	38 18		48 07	116 82		82 08	136 98	73
74	60 39	39 21		48 52	118 42		83 26	138 87	74
75	61 24	39 24		49 37	120 02		84 44	140 76	75
76	62 09	40 27		50 22	121 62		85 62	142 65	76
77	62 54	40 30		51 07	123 22		86 80	144 54	77
78	63 39	41 33		51 52	124 82		87 98	146 43	78
79	64 24	41 36		52 37	126 42		89 16	148 32	79
80	65 09	42 39		53 22	128 02		90 34	150 21	80
81	65 54	42 42		54 07	129 62		91 52	152 10	81
82	66 39	43 45		54 52	131 22		92 70	153 99	82
83	67 24	43 48		55 37	132 82		93 88	155 88	83
84	68 09	44 51		56 22	134 42		94 06	157 77	84
85	68 54	44 54		57 07	136 02		95 24	159 66	85
86	69 39	45 57		57 52	137 62		96 42	161 55	86
87	70 24	46 00		58 37	139 22		97 60	163 44	87
88	71 09	47 03		59 22	140 82		98 78	165 33	88
89	71 54	47 06		60 07	142 42		99 96	167 22	89
90	72 39	48 09		60 52	144 02		100 14	169 11	90
91	73 24	48 12		61 37	145 62		101 32	171 00	91
92	74 09	49 15		62 22	147 22		102 50	172 89	92
93	74 54	49 18		63 07	148 82		103 68	174 78	93
94	75 39	50 21		63 52	150 42		104 86	176 67	94
95	76 24	50 24		64 37	152 02		105 04	178 56	95
96	77 09	51 27		65 22	153 62		106 22	180 45	96
97	77 54	51 30		66 07	155 22		107 40	182 34	97
98	78 39	52 33		66 52	156 82		108 58	184 23	98
99	79 24	52 36		67 37	158 42		109 76	186 12	99
100	80 09	52 39		68 22	160 02		110 94	188 01	100

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	33	57		33	57		33	57	
1	N. pts.	N. pts.	1	N. pts.	N. pts.	1	N. pts.	N. pts.	1
2	00 54	00 54	2	00 55	01 08	2	01 19	01 34	2
3	01 05	01 05	3	01 30	01 38	3	01 38	01 57	3
4	01 16	01 16	4	01 41	01 46	4	01 58	02 11	4
5	01 27	01 27	5	01 52	01 56	5	02 11	02 24	5
6	01 38	01 38	6	02 03	02 06	6	02 24	02 37	6
7	01 49	01 49	7	02 14	02 17	7	02 37	02 50	7
8	01 59	01 59	8	02 25	02 28	8	02 50	03 03	8
9	02 10	02 10	9	02 36	02 39	9	03 03	03 16	9
10	02 21	02 21	10	02 47	02 50	10	03 16	03 29	10
11	02 31	02 31	11	02 58	03 01	11	03 29	03 42	11
12	02 42	02 42	12	03 09	03 12	12	03 42	03 55	12
13	02 52	02 52	13	03 20	03 23	13	03 55	04 08	13
14	03 03	03 03	14	03 31	03 34	14	04 08	04 21	14
15	03 13	03 13	15	03 42	03 45	15	04 21	04 34	15
16	03 24	03 24	16	03 53	03 56	16	04 34	04 47	16
17	03 34	03 34	17	04 04	04 07	17	04 47	05 00	17
18	03 45	03 45	18	04 15	04 18	18	05 00	05 13	18
19	03 55	03 55	19	04 26	04 29	19	05 13	05 26	19
20	04 06	04 06	20	04 37	04 40	20	05 26	05 39	20
21	04 16	04 16	21	04 48	04 51	21	05 39	05 52	21
22	04 27	04 27	22	04 59	05 02	22	05 52	06 05	22
23	04 37	04 37	23	05 10	05 13	23	06 05	06 18	23
24	04 48	04 48	24	05 21	05 24	24	06 18	06 31	24
25	04 58	04 58	25	05 32	05 35	25	06 31	06 44	25
26	05 09	05 09	26	05 43	05 46	26	06 44	06 57	26
27	05 19	05 19	27	05 54	05 57	27	06 57	07 10	27
28	05 30	05 30	28	06 05	06 08	28	07 10	07 23	28
29	05 40	05 40	29	06 16	06 19	29	07 23	07 36	29
30	05 51	05 51	30	06 27	06 30	30	07 36	07 49	30
31	06 01	06 01	31	06 38	06 41	31	07 49	08 02	31
32	06 12	06 12	32	06 49	06 52	32	08 02	08 15	32
33	06 22	06 22	33	07 00	07 03	33	08 15	08 28	33
34	06 33	06 33	34	07 11	07 14	34	08 28	08 41	34
35	06 43	06 43	35	07 22	07 25	35	08 41	08 54	35
36	06 54	06 54	36	07 33	07 36	36	08 54	09 07	36
37	07 04	07 04	37	07 44	07 47	37	09 07	09 20	37
38	07 15	07 15	38	07 55	07 58	38	09 20	09 33	38
39	07 25	07 25	39	08 06	08 09	39	09 33	09 46	39
40	07 36	07 36	40	08 17	08 20	40	09 46	09 59	40
41	07 46	07 46	41	08 28	08 31	41	09 59	10 12	41
42	07 57	07 57	42	08 39	08 42	42	10 12	10 25	42
43	08 07	08 07	43	08 50	08 53	43	10 25	10 38	43
44	08 18	08 18	44	09 01	09 04	44	10 38	10 51	44
45	08 28	08 28	45	09 12	09 15	45	10 51	11 04	45
46	08 39	08 39	46	09 23	09 26	46	11 04	11 17	46
47	08 49	08 49	47	09 34	09 37	47	11 17	11 30	47
48	08 60	08 60	48	09 45	09 48	48	11 30	11 43	48
49	08 70	08 70	49	09 56	09 59	49	11 43	11 56	49
50	08 81	08 81	50	10 07	10 10	50	11 56	12 09	50
51	08 91	08 91	51	10 18	10 21	51	12 09	12 22	51
52	09 02	09 02	52	10 29	10 32	52	12 22	12 35	52
53	09 12	09 12	53	10 40	10 43	53	12 35	12 48	53
54	09 23	09 23	54	10 51	10 54	54	12 48	13 01	54
55	09 33	09 33	55	11 02	11 05	55	13 01	13 14	55
56	09 44	09 44	56	11 13	11 16	56	13 14	13 27	56
57	09 54	09 54	57	11 24	11 27	57	13 27	13 40	57
58	10 05	10 05	58	11 35	11 38	58	13 40	13 53	58
59	10 15	10 15	59	11 46	11 49	59	13 53	14 06	59
60	10 26	10 26	60	11 57	12 00	60	14 06	14 19	60
61	10 36	10 36	61	12 08	12 11	61	14 19	14 32	61
62	10 47	10 47	62	12 19	12 22	62	14 32	14 45	62
63	10 57	10 57	63	12 30	12 33	63	14 45	14 58	63
64	11 08	11 08	64	12 41	12 44	64	14 58	15 11	64
65	11 18	11 18	65	12 52	12 55	65	15 11	15 24	65
66	11 29	11 29	66	13 03	13 06	66	15 24	15 37	66
67	11 39	11 39	67	13 14	13 17	67	15 37	15 50	67
68	11 50	11 50	68	13 25	13 28	68	15 50	16 03	68
69	12 00	12 00	69	13 36	13 39	69	16 03	16 16	69
70	12 11	12 11	70	13 47	13 50	70	16 16	16 29	70
71	12 21	12 21	71	13 58	14 01	71	16 29	16 42	71
72	12 32	12 32	72	14 09	14 12	72	16 42	16 55	72
73	12 42	12 42	73	14 20	14 23	73	16 55	17 08	73
74	12 53	12 53	74	14 31	14 34	74	17 08	17 21	74
75	13 03	13 03	75	14 42	14 45	75	17 21	17 34	75
76	13 14	13 14	76	14 53	14 56	76	17 34	17 47	76
77	13 24	13 24	77	15 04	15 07	77	17 47	18 00	77
78	13 35	13 35	78	15 15	15 18	78	18 00	18 13	78
79	13 45	13 45	79	15 26	15 29	79	18 13	18 26	79
80	13 56	13 56	80	15 37	15 40	80	18 26	18 39	80
81	14 06	14 06	81	15 48	15 51	81	18 39	18 52	81
82	14 17	14 17	82	15 59	16 02	82	18 52	19 05	82
83	14 27	14 27	83	16 10	16 13	83	19 05	19 18	83
84	14 38	14 38	84	16 21	16 24	84	19 18	19 31	84
85	14 48	14 48	85	16 32	16 35	85	19 31	19 44	85
86	14 59	14 59	86	16 43	16 46	86	19 44	19 57	86
87	15 09	15 09	87	16 54	16 57	87	19 57	20 10	87
88	15 20	15 20	88	17 05	17 08	88	20 10	20 23	88
89	15 30	15 30	89	17 16	17 19	89	20 23	20 36	89
90	15 41	15 41	90	17 27	17 30	90	20 36	20 49	90
91	15 51	15 51	91	17 38	17 41	91	20 49	21 02	91
92	16 02	16 02	92	17 49	17 52	92	21 02	21 15	92
93	16 12	16 12	93	18 00	18 03	93	21 15	21 28	93
94	16 23	16 23	94	18 11	18 14	94	21 28	21 41	94
95	16 33	16 33	95	18 22	18 25	95	21 41	21 54	95
96	16 44	16 44	96	18 33	18 36	96	21 54	22 07	96
97	16 54	16 54	97	18 44	18 47	97	22 07	22 20	97
98	17 05	17 05	98	18 55	18 58	98	22 20	22 33	98
99	17 15	17 15	99	19 06	19 09	99	22 33	22 46	99
100	17 26	17 26	100	19 17	19 20	100	22 46	22 59	100

Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	31	57	33	57	33	57	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
51	42 79	27 79	33 12	78 53	60 81	93 66	51
52	43 06	28 03	33 77	80 07	62 00	95 49	52
53	44 46	29 07	34 42	81 06	63 19	97 32	53
54	45 30	29 42	35 07	83 15	64 38	99 16	54
55	46 14	29 55	35 62	84 69	65 58	101 00	55
56	46 08	30 50	36 37	85 23	66 77	102 83	56
57	47 02	31 05	37 02	87 07	67 06	104 66	57
58	48 06	31 59	37 67	89 31	68 15	106 50	58
59	49 05	32 13	38 32	90 35	70 35	108 33	59
60	50 34	32 63	38 56	92 39	71 54	110 17	60
61	51 18	33 22	39 62	93 93	72 73	112 02	61
62	52 02	33 78	40 27	95 47	73 02	113 85	62
63	52 06	34 02	40 52	97 01	75 02	115 67	63
64	53 07	34 06	41 57	98 55	76 31	117 52	64
65	54 53	35 41	42 22	100 09	77 50	119 36	65
66	55 32	35 95	42 87	101 63	78 69	121 20	66
67	56 21	35 49	43 52	103 17	79 08	123 04	67
68	57 05	37 04	44 17	104 71	81 08	124 87	68
69	57 09	37 58	44 82	106 25	82 27	126 71	69
70	58 73	38 12	45 46	107 79	83 47	128 53	70
71	59 57	38 67	46 11	109 33	84 66	130 37	71
72	60 41	39 21	46 76	110 87	85 85	132 21	72
73	61 24	39 77	47 01	112 41	87 04	134 05	73
74	62 08	40 31	48 06	113 95	88 23	135 88	74
75	62 92	40 85	48 61	115 49	89 43	137 71	75
76	63 76	41 46	49 36	117 03	90 62	139 54	76
77	64 60	41 94	50 01	118 57	91 81	141 38	77
78	65 44	42 43	50 66	120 11	93 00	143 22	78
79	66 28	43 03	51 31	121 65	94 19	145 06	79
80	67 12	43 57	51 95	123 19	95 39	146 89	80
81	67 06	44 11	52 61	124 73	96 58	148 72	81
82	68 00	44 66	53 26	126 27	97 77	150 55	82
83	69 03	45 20	53 91	127 81	98 95	152 39	83
84	70 47	45 76	54 56	129 35	100 15	154 22	84
85	71 31	46 30	55 21	130 87	101 35	156 07	85
86	72 15	46 84	55 86	132 43	102 54	157 90	86
87	72 99	47 39	56 51	133 97	103 73	159 73	87
88	73 83	48 03	57 16	135 51	104 92	161 56	88
89	74 67	48 47	57 81	137 05	106 12	163 41	89
90	75 51	49 02	58 45	138 59	107 32	165 25	90
91	76 35	49 56	59 10	140 13	108 51	167 09	91
92	77 19	50 10	59 75	141 67	109 70	168 52	92
93	78 03	50 65	60 40	143 21	110 89	170 35	93
94	78 87	51 19	61 05	144 75	112 08	172 18	94
95	79 71	51 75	61 60	146 29	113 27	174 44	95
96	80 54	52 29	62 35	147 83	114 45	176 27	96
97	81 38	52 83	63 00	149 37	115 65	178 11	97
98	82 22	53 38	63 65	150 91	116 85	179 54	98
99	83 06	53 92	64 30	152 45	118 04	181 37	99
100	83 50	54 46	64 94	153 99	119 24	283 61	100

5 Rhumb is 56 deg. 15 min.

3 Rhumb is 33 deg. 45 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	34	56		34	56		34	56	
1	N. pts.	N. pts.	1	N. pts.	N. pts.	1	N. pts.	N. pts.	1
2	00 83	00 56	2	01 67	01 48	2	01 21	01 79	2
3	01 65	01 12	3	02 35	02 57	3	02 41	03 58	3
4	02 49	01 63	4	03 02	03 45	4	03 62	05 36	4
5	03 32	02 24	5	04 14	05 09	5	04 82	07 15	5
6	04 14	02 80	6	05 37	07 41	6	05 03	08 54	6
7	04 57	03 36	7	06 05	08 50	7	06 24	10 73	7
8	05 38	03 51	8	06 52	10 18	8	06 44	12 52	8
9	06 19	04 47	9	07 39	11 06	9	07 12	15 31	9
10	07 00	05 43	10	08 28	12 00	10	08 00	19 00	10
11	07 41	06 39	11	09 18	13 34	11	08 43	26 83	11
12	08 22	07 35	12	10 15	14 83	12	09 26	33 58	12
13	09 03	08 31	13	11 12	16 31	13	10 09	41 41	13
14	09 44	09 27	14	12 09	18 00	14	11 00	49 29	14
15	10 25	10 23	15	13 06	19 29	15	12 01	57 15	15
16	11 06	11 19	16	14 03	20 58	16	13 02	65 00	16
17	11 47	12 15	17	15 00	22 27	17	14 03	72 41	17
18	12 28	13 11	18	16 00	24 00	18	15 04	80 15	18
19	13 09	14 07	19	17 00	25 33	19	16 05	87 54	19
20	13 50	15 03	20	18 00	27 06	20	17 06	95 29	20
21	14 31	16 00	21	19 00	28 39	21	18 07	103 00	21
22	15 12	16 56	22	20 00	30 12	22	19 08	110 41	22
23	15 53	17 52	23	21 00	32 00	23	20 09	118 22	23
24	16 34	18 48	24	22 00	33 48	24	21 10	126 03	24
25	17 15	19 44	25	23 00	35 36	25	22 11	133 44	25
26	17 56	20 40	26	24 00	37 24	26	23 12	141 25	26
27	18 37	21 36	27	25 00	39 12	27	24 13	149 06	27
28	19 18	22 32	28	26 00	41 00	28	25 14	156 47	28
29	20 00	23 28	29	27 00	42 48	29	26 15	164 28	29
30	20 41	24 24	30	28 00	44 36	30	27 16	172 09	30
31	21 22	25 20	31	29 00	46 24	31	28 17	179 50	31
32	22 03	26 16	32	30 00	48 12	32	29 18	187 31	32
33	22 44	27 12	33	31 00	50 00	33	30 19	195 12	33
34	23 25	28 08	34	32 00	51 48	34	31 20	202 53	34
35	24 06	29 04	35	33 00	53 36	35	32 21	210 34	35
36	24 47	30 00	36	34 00	55 24	36	33 22	218 15	36
37	25 28	30 56	37	35 00	57 12	37	34 23	225 96	37
38	26 09	31 52	38	36 00	59 00	38	35 24	233 77	38
39	26 50	32 48	39	37 00	60 48	39	36 25	241 58	39
40	27 31	33 44	40	38 00	62 36	40	37 26	249 39	40
41	28 12	34 40	41	39 00	64 24	41	38 27	257 20	41
42	28 53	35 36	42	40 00	66 12	42	39 28	265 01	42
43	29 34	36 32	43	41 00	68 00	43	40 29	272 82	43
44	30 15	37 28	44	42 00	69 48	44	41 30	280 63	44
45	30 56	38 24	45	43 00	71 36	45	42 31	288 44	45
46	31 37	39 20	46	44 00	73 24	46	43 32	296 25	46
47	32 18	40 16	47	45 00	75 12	47	44 33	304 06	47
48	32 59	41 12	48	46 00	77 00	48	45 34	311 87	48
49	33 40	42 08	49	47 00	78 48	49	46 35	319 68	49
50	34 21	43 04	50	48 00	80 36	50	47 36	327 49	50



3 Rhumb is 33 deg. 45 min.

Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	34	56	34	56	34	56	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
1	42	28	34	40	61	51	51
2	43	11	35	07	62	02	52
3	43	54	35	17	63	13	53
4	44	07	36	27	64	24	54
5	45	20	37	37	65	35	55
6	46	33	38	48	66	46	56
7	47	46	39	58	67	57	57
8	48	59	40	08	68	08	58
9	49	12	41	18	69	19	59
10	50	25	42	28	70	30	60
11	51	38	43	38	71	41	61
12	52	51	44	48	72	52	62
13	53	04	45	58	73	03	63
14	54	17	46	08	74	14	64
15	55	30	47	18	75	25	65
16	56	43	48	28	76	36	66
17	57	56	49	38	77	47	67
18	58	09	50	48	78	58	68
19	59	22	51	58	79	09	69
20	60	35	52	08	80	20	70
21	61	48	53	18	81	31	71
22	62	01	54	28	82	42	72
23	63	14	55	38	83	53	73
24	64	27	56	48	84	04	74
25	65	40	57	58	85	15	75
26	66	53	58	08	86	26	76
27	67	06	59	18	87	37	77
28	68	19	60	28	88	48	78
29	69	32	61	38	89	59	79
30	70	45	62	48	90	10	80
31	71	58	63	58	91	21	81
32	72	11	64	08	92	32	82
33	73	24	65	18	93	43	83
34	74	37	66	28	94	54	84
35	75	50	67	38	95	05	85
36	76	03	68	48	96	16	86
37	77	16	69	58	97	27	87
38	78	29	70	08	98	38	88
39	79	42	71	18	99	49	89
40	80	55	72	28	100	60	90
41	81	08	73	38			
42	82	21	74	48			
43	83	34	75	58			
44	84	47	76	08			
45	85	60	77	18			
46	86	73	78	28			
47	87	86	79	38			
48	88	99	80	48			
49	89	12	81	58			
50	90	25	82	08			
51	91	38	83	18			
52	92	51	84	28			
53	93	04	85	38			
54	94	17	86	48			
55	95	30	87	58			
56	96	43	88	08			
57	97	56	89	18			
58	98	09	90	28			
59	99	22		38			
60	100	35		48			
61		48		58			
62		61		08			
63		74		18			
64		87		28			
65		100		38			
66				48			
67				58			
68				08			
69				18			
70				28			
71				38			
72				48			
73				58			
74				08			
75				18			
76				28			
77				38			
78				48			
79				58			
80				08			
81				18			
82				28			
83				38			
84				48			
85				58			
86				08			
87				18			
88				28			
89				38			
90				48			
91				58			
92				08			
93				18			
94				28			
95				38			
96				48			
97				58			
98				08			
99				18			
100				28			

5 Rhumb is 46 deg. 15 min.



Numbers	Sines Degrees		Tangents Degrees	Tangents Degrees	Secants Degrees	Secants Degrees	Numbers
	35	55	35	55	35	55	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
1	00 02	00 57	00 difference	01 43	01 22	01 74	1
2	01 04	01 15	01 40	02 06	02 44	03 49	2
3	02 06	01 72	02 10	04 28	03 66	05 23	3
4	03 08	02 29	02 80	05 71	04 83	06 97	4
5	04 10	02 87	03 50	07 14	05 10	08 72	5
6	04 92	03 44	04 20	08 57	07 32	10 46	6
7	05 73	04 02	04 50	10 00	08 55	12 20	7
8	06 55	04 11	05 20	11 43	09 77	13 95	8
9	07 37	05 16	06 21	12 08	10 99	15 69	9
10	08 19	05 74	07 00	14 28	12 21	17 41	10
11	09 01	06 31	07 70	15 71	13 43	19 18	11
12	09 83	06 89	08 40	17 14	14 55	20 92	12
13	10 65	07 46	09 10	18 57	15 87	22 67	13
14	11 47	08 04	09 50	19 99	17 09	24 41	14
15	12 29	08 61	10 50	21 42	18 31	26 15	15
16	13 11	09 18	11 20	22 84	19 54	27 50	16
17	13 93	09 76	11 50	24 28	20 76	29 64	17
18	14 74	10 33	12 40	25 70	21 98	31 39	18
19	15 55	10 91	13 30	27 13	23 20	33 03	19
20	16 38	11 47	14 00	28 56	24 42	34 87	20
21	17 21	12 05	14 70	30 00	25 64	36 62	21
22	18 03	12 62	15 40	31 43	26 86	38 35	22
23	18 85	13 19	16 10	32 86	28 08	40 10	23
24	19 67	13 77	16 50	34 28	29 30	41 85	24
25	20 48	14 34	17 50	35 71	30 52	43 59	25
26	21 30	14 92	18 21	37 14	31 74	45 34	26
27	22 13	15 48	18 51	38 56	32 96	47 08	27
28	22 95	16 06	19 01	40 00	34 18	48 82	28
29	23 76	16 63	20 31	41 43	35 40	50 57	29
30	24 58	17 21	21 01	42 85	36 62	52 30	30
31	25 39	17 78	21 71	44 27	37 84	54 05	31
32	26 22	18 35	22 41	45 70	39 06	55 80	32
33	27 04	19 93	23 11	47 13	40 28	57 54	33
34	27 86	19 49	23 51	48 56	41 50	59 29	34
35	28 68	20 07	24 51	49 99	42 73	61 03	35
36	29 49	20 64	25 21	51 42	43 95	62 77	36
37	30 31	21 22	25 51	52 84	45 17	64 52	37
38	31 14	21 79	26 01	54 27	46 39	66 26	38
39	31 96	22 35	27 01	55 70	47 61	68 00	39
40	32 77	22 94	28 01	57 13	48 83	69 74	40
41	33 59	23 50	28 71	58 56	50 05	71 49	41
42	34 40	24 08	29 41	59 8	51 27	73 23	42
43	35 23	24 65	30 11	61 41	52 49	74 97	43
44	36 05	25 23	30 51	62 83	53 71	76 72	44
45	36 87	25 80	31 51	64 27	54 93	78 46	45
46	37 69	26 36	32 21	65 69	56 15	80 20	46
47	38 50	26 94	32 51	67 12	57 37	81 95	47
48	39 32	27 52	33 51	68 55	58 59	83 69	48
49	40 14	28 10	34 31	69 98	59 81	85 44	49
50	40 56	28 68	35 01	71 41	61 04	87 18	50

Numbers	Sines Degrees			Tangents Degrees			Secants. Degrees.		Numbers
	35	55		35	55		35	55	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	41 78	29 25		35 71	72 84		62 26	83 92	51
52	42 60	29 08		36 41	74 26		63 04	83 67	52
53	43 04	30 39		37 11	75 59		64 07	84 41	53
54	44 24	30 56		37 50	77 12		65 02	85 15	54
55	45 06	31 54		38 51	78 55		67 14	85 92	55
56	45 88	32 12		39 21	79 58		68 36	87 64	56
57	46 70	32 07		39 51	81 41		69 58	89 39	57
58	47 51	33 27		40 61	83 23		70 50	91 13	58
59	48 33	33 54		41 31	84 26		72 02	92 37	59
60	49 15	34 42		42 01	85 69		73 25	94 61	60
61	49 97	34 98		42 71	87 12		74 47	96 36	61
62	50 79	35 56		43 41	88 55		75 69	98 10	62
63	51 61	36 14		44 11	89 58		76 51	99 35	63
64	52 42	36 72		44 81	91 41		78 13	101 59	64
65	53 25	37 29		45 51	92 83		79 35	113 34	65
66	54 07	37 86		45 21	94 26		80 57	115 08	66
67	54 89	38 44		46 51	95 69		81 79	116 52	67
68	55 71	39 00		47 61	97 12		83 01	118 57	68
69	56 52	39 57		48 31	98 55		84 23	120 30	69
70	57 34	40 15		49 01	99 57		85 46	122 04	70
71	58 16	40 72		49 71	101 40		86 68	123 80	71
72	58 98	41 29		50 41	102 52		87 90	125 54	72
73	59 80	41 87		51 11	104 25		89 12	127 29	73
74	60 62	42 44		51 81	105 68		90 34	129 03	74
75	61 44	43 02		52 51	107 11		91 56	130 77	75
76	62 27	43 59		53 22	108 54		92 78	132 52	76
77	63 09	44 16		53 52	109 57		94 00	134 25	77
78	63 91	44 74		54 62	111 40		95 22	136 00	78
79	64 73	45 31		55 32	112 48		96 44	137 34	79
80	65 54	45 89		56 02	114 26		97 66	139 48	80
81	66 36	46 46		56 72	115 59		98 88	141 23	81
82	67 18	47 04		57 42	117 12		100 10	142 97	82
83	68 00	47 61		58 12	118 55		101 32	144 72	83
84	68 82	48 18		58 82	119 58		102 54	146 46	84
85	69 64	48 76		59 52	121 41		103 76	148 20	85
86	70 46	49 33		60 22	122 83		104 98	149 95	86
87	71 28	49 51		60 52	124 25		106 20	151 59	87
88	72 10	50 47		61 62	125 69		107 42	153 44	88
89	72 52	51 05		62 32	127 12		108 64	155 18	89
90	73 73	51 62		63 02	128 54		109 87	156 52	90
91	74 55	52 19		63 72	129 57		111 09	158 67	91
92	75 37	52 77		64 42	131 40		112 31	160 41	92
93	76 19	53 34		65 12	132 52		113 53	162 15	93
94	77 01	53 52		65 82	134 26		114 75	163 40	94
95	77 83	54 48		66 54	135 68		115 97	165 64	95
96	78 65	55 06		67 22	137 11		117 19	167 39	96
97	79 47	55 63		67 52	138 54		118 41	169 13	97
98	80 29	56 21		68 62	139 97		120 63	170 87	98
99	81 11	56 78		69 32	141 40		121 85	172 62	99
100	81 92	57 36		70 02	142 82		122 05	174 35	100

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	36	54		36	54		36	54	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 31	00 59	1	00 73	01 38	1	01 24	01 70	1
2	01 02	01 18	2	01 45	02 15	2	01 47	02 40	2
3	02 02	01 25	3	02 13	04 13	3	03 17	05 10	3
4	03 24	02 35	4	02 51	05 51	4	04 31	06 50	4
5	04 05	02 54	5	03 03	05 58	5	05 18	08 51	5
6	04 45	03 53	6	04 36	08 25	6	07 42	10 21	6
7	05 26	04 11	7	05 09	09 03	7	08 06	11 01	7
8	06 07	04 40	8	05 51	10 01	8	09 13	13 06	8
9	06 48	05 09	9	06 32	11 02	9	10 35	15 31	9
10	07 29	05 38	10	07 13	12 06	10	11 58	17 02	10
11	08 10	05 45	11	08 00	13 14	11	13 21	18 17	11
12	08 51	07 05	12	08 43	14 22	12	14 44	20 42	12
13	09 32	07 16	13	09 25	15 28	13	16 07	22 12	13
14	10 13	08 23	14	10 08	16 15	14	17 30	24 08	14
15	10 54	09 32	15	10 51	17 06	15	18 53	25 52	15
16	11 35	09 41	16	11 38	18 02	16	19 56	27 22	16
17	12 16	10 00	17	12 21	19 00	17	20 59	28 52	17
18	12 57	10 19	18	13 04	20 00	18	22 02	30 02	18
19	13 38	10 38	19	13 47	21 00	19	23 05	31 04	19
20	14 19	10 57	20	14 30	22 00	20	24 08	32 06	20
21	15 00	11 16	21	15 13	23 00	21	25 11	33 08	21
22	15 41	11 35	22	16 00	24 00	22	26 14	34 10	22
23	16 22	11 54	23	16 47	25 00	23	27 17	35 12	23
24	17 03	12 13	24	17 34	26 00	24	28 20	36 14	24
25	17 44	12 32	25	18 21	27 00	25	29 23	37 16	25
26	18 25	12 51	26	19 08	28 00	26	30 26	38 18	26
27	19 06	13 10	27	19 55	29 00	27	31 29	39 20	27
28	19 47	13 29	28	20 42	30 00	28	32 32	40 22	28
29	20 28	13 48	29	21 29	31 00	29	33 35	41 24	29
30	21 09	14 07	30	22 16	32 00	30	34 38	42 26	30
31	21 50	14 26	31	23 03	33 00	31	35 41	43 28	31
32	22 31	14 45	32	23 50	34 00	32	36 44	44 30	32
33	23 12	15 04	33	24 37	35 00	33	37 47	45 32	33
34	23 53	15 23	34	25 24	36 00	34	38 50	46 34	34
35	24 34	15 42	35	26 11	37 00	35	39 53	47 36	35
36	25 15	16 01	36	26 58	38 00	36	40 56	48 38	36
37	25 56	16 20	37	27 45	39 00	37	41 59	49 40	37
38	26 37	16 39	38	28 32	40 00	38	43 02	50 42	38
39	27 18	16 58	39	29 19	41 00	39	44 05	51 44	39
40	27 59	17 17	40	30 06	42 00	40	45 08	52 46	40
41	28 40	17 36	41	30 53	43 00	41	46 11	53 48	41
42	29 21	17 55	42	31 40	44 00	42	47 14	54 50	42
43	30 02	18 14	43	32 27	45 00	43	48 17	55 52	43
44	30 43	18 33	44	33 14	46 00	44	49 20	56 54	44
45	31 24	18 52	45	34 01	47 00	45	50 23	57 56	45
46	32 05	19 11	46	34 48	48 00	46	51 26	58 58	46
47	32 46	19 30	47	35 35	49 00	47	52 29	59 60	47
48	33 27	19 49	48	36 22	50 00	48	53 32	60 62	48
49	34 08	20 08	49	37 09	51 00	49	54 35	61 64	49
50	34 49	20 27	50	37 56	52 00	50	55 38	62 66	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	36	54		35	54		36	54	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	41. 26	29 98		37 05	70 19		63 04	86 77	51
52	42 07	30 57		37 17	71 57		64 027	88 47	52
53	42 58	31 16		38 45	72 54		65 050	90 17	53
54	43 069	31 74		39 24	74 32		66 574	91 287	54
55	44 50	32 33		39 96	75 69		67 97	93 57	55
56	45 30	32 92		40 69	77 07		69 21	95 27	56
57	46 11	33 050		41 41	78 045		70 045	96 97	57
58	46 52	34 309		42 54	79 083		71 068	98 68	58
59	47 073	34 68		42 837	81 20		72 92	100 38	59
60	48 54	35 27		43 59	82 58		74 17	102 08	60
61	49 35	35 86		44 32	83 95		75 40	103 78	61
62	50 16	36 04		45 04	85 33		76 63	105 48	62
63	50 97	37 000		45 71	86 30		77 01	107 18	63
64	51 78	37 61		46 49	88 08		79 01	108 88	64
65	52 59	38 20		47 23	89 46		80 34	110 58	65
66	53 39	38 79		47 95	90 84		81 58	112 29	66
67	54 20	39 038		48 16	92 21		82 132	113 99	67
68	55 01	39 97		49 10	93 59		84 006	115 69	68
69	55 82	40 55		50 13	94 96		85 29	117 39	69
70	56 63	41 15		50 86	96 35		86 53	119 09	70
71	57 44	41 73		51 58	97 71		87 76	120 79	71
72	58 25	42 32		52 31	99 09		89 00	122 49	72
73	59 06	43 01		53 03	100 47		90 134	124 19	73
74	59 87	43 40		53 86	101 85		91 17	125 89	74
75	60 68	44 08		54 48	103 22		92 71	127 59	75
76	61 48	44 67		55 22	104 60		93 94	129 30	76
77	62 29	45 26		56 04	105 97		95 18	131 00	77
78	63 10	45 85		56 12	107 35		96 42	132 70	78
79	63 91	46 43		57 39	108 73		97 65	134 40	79
80	64 72	47 02		58 12	110 11		98 89	136 10	80
81	65 53	47 60		58 85	111 48		100 15	137 80	81
82	66 34	48 19		59 53	112 86		101 36	139 50	82
83	67 15	48 78		60 30	114 23		102 59	141 21	83
84	67 96	49 37		61 02	115 61		103 83	142 91	84
85	68 77	49 96		62 85	116 98		105 06	144 61	85
86	69 57	50 55		62 47	118 36		106 30	146 31	86
87	70 38	51 14		63 21	119 74		107 53	148 01	87
88	71 19	51 72		63 93	121 12		108 77	149 71	88
89	72 00	52 31		64 66	122 50		110 01	151 42	89
90	72 81	52 90		65 39	123 88		111 25	153 12	90
91	73 62	53 48		66 11	125 25		112 48	154 82	91
92	74 43	54 07		66 84	126 63		113 72	156 52	92
93	75 24	54 66		67 56	128 00		114 95	158 22	93
94	76 05	55 25		68 29	129 38		116 19	159 92	94
95	76 86	55 84		69 01	130 75		117 43	161 62	95
96	77 66	56 43		69 84	132 13		118 66	163 33	96
97	78 47	57 02		70 46	133 51		119 50	165 03	97
98	79 28	57 60		71 20	134 89		121 13	166 73	98
99	80 09	58 19		71 92	135 26		122 37	168 43	99
100	80 90	58 78		72 65	137 64		123 61	170 13	100

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3. Rhumb and a quarter is 36 deg. 34 min



3 Rhumb and a quarter is 36 deg. 34 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	37	53		37	53		37	53	
	N. pts	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	40 73	30 69	51	38 43	67 66	51	63 86	84 74	51
52	41 53	31 0 29	52	39 19	68 99	52	65 12	85 40	52
53	42 33	31 7 90	53	39 44	70 32	53	66 37	86 0 5	53
54	43 13	32 4 50	54	40 69	71 65	54	67 52	87 73	54
55	43 93	33 10	55	41 45	72 97	55	68 87	88 39	55
56	44 72	33 77	56	42 20	74 31	56	70 13	93 05	56
57	45 52	34 0 30	57	42 59	75 62	57	71 0 39	94 0 71	57
58	46 30	34 6 50	58	43 71	76 94	58	72 0 63	96 37	58
59	47 12	35 51	59	44 46	78 28	59	73 0 88	98 03	59
60	47 92	36 11	60	45 21	79 62	60	75 13	99 70	60
61	48 72	36 71	61	45 97	80 94	61	76 39	108 36	61
62	49 52	37 0 31	62	46 73	82 26	62	77 0 4	103 0 2	62
63	50 30	37 8 52	63	47 47	83 59	63	78 0 9	104 0 68	63
64	51 11	38 6 12	64	48 23	84 52	64	80 5 14	106 0 34	64
65	51 91	39 12	65	48 98	85 24	65	81 40	108 00	65
66	52 71	39 72	66	49 74	87 58	66	82 65	109 66	66
67	53 51	40 0 32	67	50 49	89 50	67	83 1 30	111 32	67
68	54 30	40 8 52	68	51 24	90 22	68	85 16	112 0 98	68
69	55 11	41 53	69	52 00	91 55	69	86 41	114 0 65	69
70	55 90	42 13	70	52 75	92 89	70	87 65	116 31	70
71	56 70	42 73	71	53 50	94 21	71	88 81	117 97	71
72	57 50	43 33	72	54 26	95 53	72	90 17	119 0 63	72
73	58 30	43 0 93	73	55 01	96 85	73	91 42	121 0 29	73
74	59 10	44 53	74	55 77	98 18	74	92 66	122 0 95	74
75	59 90	45 14	75	56 52	99 51	75	93 92	124 62	75
76	60 69	45 74	76	57 27	100 83	76	95 17	125 28	76
77	61 49	46 1 34	77	58 03	102 16	77	96 43	127 0 4	77
78	62 29	46 8 54	78	58 79	103 49	78	97 68	129 0 60	78
79	63 08	47 54	79	59 54	104 82	79	98 93	131 25	79
80	63 88	48 14	80	60 28	106 16	80	100 17	132 93	80
81	64 69	48 75	81	61 04	107 48	81	101 44	134 58	81
82	65 49	49 1 35	82	61 80	108 30	82	102 54	136 25	82
83	66 29	49 8 55	83	62 55	110 13	83	103 54	137 0 91	83
84	67 09	50 51	84	63 30	111 45	84	105 19	139 57	84
85	67 89	51 15	85	64 06	112 77	85	106 45	141 23	85
86	68 68	51 75	86	64 81	114 11	86	107 70	142 89	86
87	69 49	52 36	87	65 56	115 43	87	108 85	144 55	87
88	70 25	52 65	88	66 03	116 75	88	110 21	145 22	88
89	71 08	53 55	89	66 87	118 09	89	111 45	147 0 88	89
90	71 88	54 16	90	67 82	119 43	90	112 70	149 55	90
91	72 68	54 76	91	68 58	120 75	91	113 96	151 20	91
92	73 47	55 36	92	69 33	122 07	92	115 21	152 86	92
93	74 27	55 97	93	70 09	123 40	93	116 55	154 52	93
94	75 07	56 57	94	70 34	124 73	94	117 52	156 18	94
95	75 87	57 17	95	71 59	126 06	95	118 96	157 85	95
96	76 67	57 77	96	72 35	127 40	96	120 22	159 51	96
97	77 47	58 37	97	73 10	128 71	97	121 47	161 17	97
98	78 27	58 98	98	73 85	130 05	98	122 0 72	162 83	98
99	79 06	59 58	99	74 61	131 37	99	123 97	164 49	99
100	79 86	60 18	100	75 36	132 70	100	125 22	166 16	100

4 Rhumb and three quarters is 53 deg. 26 min.



Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	38	52		38	52		38	52	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00	00		00	00		01	01	1
2	01	01		01	01		02	02	2
3	02	02		02	02		03	03	3
4	03	03		03	03		04	04	4
5	04	04		04	04		05	05	5
6	05	05		05	05		06	06	6
7	06	06		06	06		07	07	7
8	07	07		07	07		08	08	8
9	08	08		08	08		09	09	9
10	09	09		09	09		10	10	10
11	10	10		10	10		11	11	11
12	11	11		11	11		12	12	12
13	12	12		12	12		13	13	13
14	13	13		13	13		14	14	14
15	14	14		14	14		15	15	15
16	15	15		15	15		16	16	16
17	16	16		16	16		17	17	17
18	17	17		17	17		18	18	18
19	18	18		18	18		19	19	19
20	19	19		19	19		20	20	20
21	20	20		20	20		21	21	21
22	21	21		21	21		22	22	22
23	22	22		22	22		23	23	23
24	23	23		23	23		24	24	24
25	24	24		24	24		25	25	25
26	25	25		25	25		26	26	26
27	26	26		26	26		27	27	27
28	27	27		27	27		28	28	28
29	28	28		28	28		29	29	29
30	29	29		29	29		30	30	30
31	30	30		30	30		31	31	31
32	31	31		31	31		32	32	32
33	32	32		32	32		33	33	33
34	33	33		33	33		34	34	34
35	34	34		34	34		35	35	35
36	35	35		35	35		36	36	36
37	36	36		36	36		37	37	37
38	37	37		37	37		38	38	38
39	38	38		38	38		39	39	39
40	39	39		39	39		40	40	40
41	40	40		40	40		41	41	41
42	41	41		41	41		42	42	42
43	42	42		42	42		43	43	43
44	43	43		43	43		44	44	44
45	44	44		44	44		45	45	45
46	45	45		45	45		46	46	46
47	46	46		46	46		47	47	47
48	47	47		47	47		48	48	48
49	48	48		48	48		49	49	49
50	49	49		49	49		50	50	50

Numbers	Sines Degrees		Tangents Degrees		Secants. Degrees.		Numbers
	38	52	38	52	38	52	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
51	40 19	31 40	39 84	65 28	64 72	82 84	51
52	40 58	32 01	40 1 63	66 56	65 00	84 46	52
53	41 37	32 22	41 55 41	67 34	67 27	86 09	53
54	42 15	32 43	42 33 19	68 12	68 54	87 17	54
55	42 54	33 04	43 11	69 40	69 81	88 34	55
56	43 32	33 25	43 49	70 68	71 07	90 96	56
57	44 11	33 46	44 28	71 56	72 33	92 59	57
58	44 50	34 07	45 06	72 44	73 00	94 21	58
59	45 29	34 28	45 45	73 34	74 07	95 84	59
60	46 08	34 49	46 24	74 24	75 14	97 46	60
61	46 47	35 10	47 03	75 42	76 41	99 09	61
62	47 26	35 31	47 42	76 30	77 40	100 57	62
63	48 05	35 52	48 21	77 18	78 59	102 34	63
64	48 44	36 13	49 00	78 06	80 00	103 56	64
65	49 23	36 34	49 39	79 00	81 22	105 59	65
66	50 02	36 55	50 18	80 00	82 49	107 21	66
67	50 41	37 16	50 57	81 00	83 76	108 33	67
68	51 20	37 37	51 36	82 00	85 02	110 45	68
69	51 59	37 58	52 15	83 00	86 29	112 08	69
70	52 38	38 19	52 54	84 00	87 56	113 30	70
71	53 17	38 40	53 33	85 00	89 23	115 33	71
72	53 56	39 01	54 12	86 00	91 37	117 36	72
73	54 35	39 22	54 51	87 00	92 54	118 58	73
74	55 14	39 43	55 30	88 00	94 11	120 20	74
75	55 53	40 04	56 09	89 00	95 18	121 42	75
76	56 32	40 25	56 48	90 00	96 45	123 44	76
77	57 11	40 46	57 27	91 00	97 52	125 07	77
78	57 50	41 07	58 06	92 00	99 00	126 29	78
79	58 29	41 28	58 45	93 00	100 26	128 32	79
80	59 08	41 49	59 24	94 00	101 52	129 54	80
81	59 47	42 10	60 03	95 00	102 80	131 58	81
82	60 26	42 31	60 42	96 00	104 10	133 20	82
83	61 05	42 52	61 21	97 00	105 32	134 82	83
84	61 44	43 13	62 00	98 00	106 59	136 44	84
85	62 23	43 34	62 39	99 00	107 87	138 07	85
86	63 02	43 55	63 18	100 00	109 13	139 69	86
87	63 41	44 16	63 57	101 00	110 40	141 32	87
88	64 20	44 37	64 36	102 00	111 57	142 54	88
89	64 59	44 58	65 15	103 00	112 54	144 17	89
90	65 38	45 19	65 54	104 00	114 21	145 19	90
91	66 17	45 40	66 33	105 00	115 48	147 82	91
92	66 56	46 01	67 12	106 00	116 55	149 44	92
93	67 35	46 22	67 51	107 00	118 01	151 07	93
94	68 14	46 43	68 30	108 00	119 28	152 69	94
95	68 53	47 04	69 09	109 00	120 55	154 31	95
96	69 32	47 25	69 48	110 00	121 82	155 93	96
97	70 11	47 46	70 27	111 00	123 09	157 56	97
98	70 50	48 07	71 06	112 00	124 36	159 18	98
99	71 29	48 28	71 45	113 00	125 63	160 81	99
100	72 08	48 49	72 24	114 00	126 50	162 43	100

4 Rhumb and a half is 50 deg. 37 min.

3 Rhumb and a half is 39 deg. 23 min.

Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	39	51	39	51	39	51	
1	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	1
2	00 00	00 00	00 00	01 23	01 29	01 59	2
3	01 55	01 55	01 55	02 47	02 57	03 18	3
4	03 33	03 33	03 33	04 03	04 06	04 27	4
5	05 11	05 11	05 11	05 17	05 15	05 36	5
6	06 50	06 50	06 50	06 24	06 43	07 05	6
7	08 29	08 29	08 29	07 32	07 72	08 10	7
8	10 08	10 08	10 08	08 41	09 01	10 12	8
9	11 47	11 47	11 47	09 50	10 29	11 12	9
10	13 26	13 26	13 26	10 59	11 48	12 30	10
11	15 05	15 05	15 05	12 18	12 58	14 03	11
12	16 44	16 44	16 44	13 37	14 15	15 49	12
13	18 23	18 23	18 23	14 56	15 08	17 08	13
14	19 52	19 52	19 52	16 15	16 08	18 28	14
15	21 31	21 31	21 31	17 34	17 21	19 48	15
16	23 10	23 10	23 10	18 53	18 30	21 08	16
17	24 49	24 49	24 49	20 12	19 49	22 28	17
18	26 28	26 28	26 28	21 31	21 08	23 48	18
19	28 07	28 07	28 07	22 50	22 27	25 08	19
20	29 46	29 46	29 46	24 09	23 46	26 28	20
21	31 25	31 25	31 25	25 28	24 65	27 48	21
22	33 04	33 04	33 04	26 47	25 84	29 08	22
23	34 43	34 43	34 43	28 06	26 43	30 28	23
24	36 22	36 22	36 22	29 25	27 62	31 48	24
25	38 01	38 01	38 01	30 44	28 81	33 08	25
26	39 80	39 80	39 80	32 03	29 00	34 28	26
27	41 59	41 59	41 59	33 22	30 19	35 48	27
28	43 18	43 18	43 18	34 41	31 38	37 08	28
29	44 37	44 37	44 37	35 60	32 57	38 28	29
30	45 56	45 56	45 56	36 79	34 16	39 48	30
31	47 15	47 15	47 15	38 00	35 35	41 08	31
32	48 34	48 34	48 34	39 19	36 54	42 28	32
33	49 53	49 53	49 53	40 38	38 13	43 48	33
34	51 12	51 12	51 12	41 57	39 32	45 08	34
35	52 31	52 31	52 31	43 16	40 51	46 28	35
36	53 50	53 50	53 50	44 35	42 10	47 48	36
37	55 09	55 09	55 09	45 54	43 29	49 08	37
38	56 28	56 28	56 28	47 13	44 48	50 28	38
39	57 47	57 47	57 47	48 32	46 07	51 48	39
40	59 06	59 06	59 06	49 51	47 26	53 08	40
41	60 25	60 25	60 25	51 10	48 45	54 28	41
42	61 44	61 44	61 44	52 29	49 64	55 48	42
43	63 03	63 03	63 03	53 48	50 83	57 08	43
44	64 22	64 22	64 22	54 67	52 02	58 28	44
45	65 41	65 41	65 41	55 86	53 21	59 48	45
46	67 00	67 00	67 00	57 05	54 40	61 08	46
47	68 19	68 19	68 19	58 24	55 59	62 28	47
48	69 38	69 38	69 38	59 43	57 18	63 48	48
49	70 57	70 57	70 57	61 02	58 37	65 08	49
50	72 16	72 16	72 16	62 21	59 56	66 28	50

3 Rhumb and a half is 39 deg. 23 min.

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	32	51		39	51		39	51	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	39 63	32 09		41 30	62 98		65 63	81 04	51
52	40 42	32 07		42 11	63 22		66 02	82 53	52
53	41 19	33 35		42 52	65 45		68 41	84 22	53
54	41 06	33 29		43 73	66 59		69 39	85 18	54
55	42 74	34 61		44 54	67 93		70 78	87 40	55
56	43 51	35 24		45 35	69 16		72 07	88 90	56
57	44 29	35 08		46 16	70 39		73 35	90 58	57
58	45 07	36 50		46 57	71 63		74 64	92 16	58
59	45 08	37 13		47 38	72 87		75 93	93 75	59
60	45 63	37 76		48 59	74 09		77 21	95 34	60
61	47 41	38 39		49 40	75 34		79 50	96 93	61
62	48 19	39 01		50 21	76 57		79 78	98 52	62
63	49 06	39 64		51 02	77 81		81 07	100 11	63
64	49 74	40 27		51 83	79 04		82 36	101 30	64
65	50 51	40 90		52 64	80 28		83 64	103 29	65
66	51 29	41 53		53 45	81 51		84 93	104 88	66
67	52 07	42 16		54 26	82 74		85 22	106 47	67
68	52 18	42 79		55 07	83 97		87 50	108 05	68
69	53 63	43 42		55 88	85 21		88 79	109 24	69
70	54 40	44 05		56 69	86 44		90 08	111 23	70
71	55 18	44 64		57 50	87 67		91 36	112 82	71
72	55 95	45 31		58 31	88 92		92 15	114 41	72
73	56 73	45 94		59 12	90 15		93 34	116 00	73
74	57 50	46 57		59 95	91 38		95 22	117 59	74
75	58 28	47 20		60 74	92 62		96 51	119 18	75
76	59 66	47 83		61 54	93 86		97 79	120 77	76
77	59 84	48 46		62 35	95 09		99 08	122 36	77
78	60 62	49 09		63 16	96 33		100 37	123 95	78
79	61 40	49 72		63 97	97 56		101 65	125 53	79
80	62 18	50 34		64 78	98 79		102 94	127 12	80
81	62 95	50 98		65 59	100 08		104 23	128 71	81
82	63 73	51 61		66 40	101 27		105 51	130 30	82
83	64 50	52 24		67 21	102 50		106 80	131 89	83
84	65 28	52 86		68 02	103 73		108 09	133 48	84
85	66 06	53 50		68 83	104 96		109 37	135 07	85
86	66 84	54 13		69 64	106 20		110 66	136 66	86
87	67 62	54 76		70 45	107 43		111 95	138 25	87
88	68 40	55 39		71 26	108 67		113 23	139 84	88
89	69 18	56 01		72 07	109 91		114 52	141 42	89
90	69 55	56 64		72 88	111 14		115 81	143 01	90
91	70 72	57 27		73 69	112 37		117 10	144 60	91
92	71 49	57 90		74 50	113 61		118 39	146 19	92
93	72 27	58 53		75 31	114 85		119 67	147 78	93
94	73 05	59 16		76 12	116 07		120 96	149 37	94
95	73 83	59 79		76 93	117 32		122 25	150 96	95
96	74 62	60 42		77 74	118 55		123 53	152 54	96
97	75 40	61 05		78 55	119 78		124 82	154 13	97
98	76 18	61 68		79 36	121 02		126 11	155 72	98
99	76 95	62 31		80 17	122 26		127 39	157 31	99
100	77 72	62 93		80 98	123 49		128 63	159 00	100

4 Rhumb and a half 56 deg. 73 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	40	50		40	50		40	50	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 77	00 64	1	00 84	01 19	1	01 31	01 56	1
2	01 53	01 29	2	01 53	02 38	2	02 61	03 11	2
3	02 30	01 93	3	02 52	03 58	3	03 39	04 57	3
4	03 06	02 57	4	03 36	04 77	4	05 22	06 22	4
5	03 83	03 21	5	04 20	05 95	5	06 53	07 78	5
6	04 60	03 86	6	05 03	07 15	6	07 83	09 33	6
7	05 36	04 50	7	05 47	08 34	7	09 14	10 38	7
8	06 13	05 14	8	06 21	09 53	8	10 44	12 04	8
9	06 89	05 79	9	07 55	10 73	9	11 16	14 00	9
10	07 66	06 43	10	08 39	11 92	10	13 05	15 56	10
11	08 43	07 97	11	09 23	13 11	11	14 36	17 11	11
12	09 19	07 71	12	10 07	14 30	12	15 06	18 57	12
13	09 56	08 36	13	10 51	15 50	13	16 37	20 22	13
14	10 32	09 17	14	11 35	16 79	14	18 27	21 78	14
15	11 09	09 64	15	12 59	17 88	15	19 58	23 33	15
16	12 26	10 28	16	13 43	19 07	16	20 88	24 89	16
17	13 02	10 53	17	14 26	20 26	17	22 19	26 45	17
18	13 39	11 57	18	15 10	21 45	18	23 49	28 00	18
19	14 15	12 21	19	15 54	22 65	19	25 36	29 56	19
20	15 32	12 85	20	16 78	23 84	20	26 11	31 11	20
21	16 08	13 50	21	17 62	25 03	21	27 41	32 67	21
22	16 45	14 14	22	18 46	26 22	22	28 72	34 22	22
23	17 21	14 39	23	19 30	27 42	23	30 02	35 78	23
24	18 03	15 43	24	20 13	28 61	24	31 45	37 03	24
25	19 15	16 07	25	20 97	29 80	25	32 63	38 89	25
26	19 51	16 71	26	21 81	30 99	26	33 94	40 45	26
27	20 28	17 36	27	22 65	32 18	27	35 04	42 00	27
28	21 05	18 00	28	23 49	33 37	28	36 51	43 56	28
29	22 21	18 34	29	24 33	34 56	29	37 55	45 11	29
30	22 98	19 28	30	25 17	35 75	30	39 16	46 67	30
31	23 74	19 93	31	26 01	36 95	31	40 46	48 22	31
32	24 51	20 57	32	26 45	38 14	32	41 77	49 78	32
33	25 28	21 21	33	27 29	39 33	33	43 07	51 33	33
34	26 04	21 46	34	28 53	40 52	34	44 38	52 89	34
35	26 81	22 50	35	29 36	41 71	35	45 68	54 45	35
36	27 57	23 14	36	30 20	42 91	36	46 99	56 00	36
37	28 34	23 79	37	31 04	44 10	37	48 29	57 56	37
38	29 10	24 43	38	31 88	45 29	38	49 60	59 11	38
39	29 87	25 07	39	32 72	46 48	39	50 91	60 67	39
40	30 64	25 71	40	33 56	47 67	40	52 22	62 23	40
41	31 40	26 36	41	34 40	48 86	41	53 53	63 78	41
42	32 17	27 00	42	35 23	50 05	42	54 83	65 33	42
43	32 53	27 64	43	36 07	51 24	43	56 14	66 89	43
44	33 30	28 28	44	36 51	52 43	44	57 44	68 45	44
45	34 47	28 93	45	37 35	53 63	45	58 75	70 00	45
46	35 23	29 57	46	38 59	54 82	46	60 05	71 56	46
47	36 00	30 21	47	39 43	56 01	47	61 36	73 11	47
48	36 76	30 86	48	40 27	57 20	48	62 66	74 67	48
49	37 53	31 50	49	41 11	58 40	49	63 97	76 22	49
50	38 30	32 14	50	41 56	59 59	50	65 27	77 78	50



Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	40	50	40	50	40	50	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
51	39 06	32 79	42 80	60 78	65 58	79 33	51
52	39 08	33 04	43 16	61 08	67 18	80 59	52
53	40 06	34 07	44 08	62 17	69 04	82 45	53
54	41 06	34 71	45 32	64 36	70 49	84 00	54
55	42 13	35 35	46 15	65 55	71 86	85 55	55
56	42 89	36 00	46 99	66 74	73 10	87 11	56
57	43 66	36 64	47 18	67 93	74 41	88 57	57
58	44 04	37 28	48 07	69 12	75 74	90 22	58
59	45 01	37 93	49 51	70 31	77 02	91 78	59
60	45 96	38 57	50 35	71 50	78 32	93 34	60
61	46 72	39 21	51 19	72 70	79 63	94 89	61
62	47 49	39 86	52 02	73 89	80 19	96 04	62
63	48 26	40 50	52 46	75 08	82 24	98 00	63
64	49 02	41 14	53 70	76 27	83 54	99 56	64
65	49 79	41 79	54 54	77 46	84 85	101 11	65
66	50 55	42 43	55 38	78 65	86 15	102 67	66
67	51 32	43 07	56 22	79 85	87 46	104 22	67
68	52 08	43 71	57 06	81 04	88 76	105 78	68
69	52 86	44 36	57 49	82 23	90 47	107 33	69
70	53 62	45 00	58 74	83 42	91 38	108 90	70
71	54 38	45 64	59 58	84 62	92 68	110 45	71
72	55 15	46 28	60 42	85 81	93 19	112 00	72
73	55 51	46 93	61 25	87 00	95 29	113 56	73
74	56 28	47 57	62 09	88 19	96 43	115 11	74
75	57 41	48 21	62 93	89 38	97 50	116 67	75
76	58 25	48 86	63 77	90 57	99 21	118 22	76
77	58 58	49 50	64 10	91 76	100 51	119 78	77
78	59 30	50 14	64 45	92 95	101 58	121 33	78
79	60 01	50 77	65 30	94 15	103 12	122 89	79
80	61 28	51 42	67 13	95 34	104 43	124 46	80
81	62 04	52 07	67 76	96 53	105 73	126 01	81
82	62 38	52 71	68 38	97 72	107 04	127 57	82
83	63 07	53 36	69 04	98 91	108 34	129 12	83
84	63 34	54 00	70 48	100 10	109 53	130 68	84
85	65 10	54 64	71 32	101 30	110 49	132 24	85
86	65 87	55 28	72 16	102 49	112 26	133 79	86
87	66 64	55 93	73 00	103 68	113 57	135 34	87
88	67 40	56 57	73 44	104 87	114 78	136 90	88
89	68 17	57 21	74 28	106 07	116 18	138 46	89
90	68 94	57 45	75 52	107 25	117 49	140 01	90
91	69 70	58 50	76 36	108 45	118 79	141 57	91
92	70 47	59 14	77 20	109 64	120 10	143 12	92
93	71 23	59 37	78 03	110 83	121 40	144 68	93
94	72 00	60 43	78 47	112 02	122 57	146 23	94
95	72 76	61 07	79 71	113 22	124 01	147 79	95
96	73 53	61 71	80 55	114 41	125 32	149 34	96
97	74 30	62 35	81 39	115 60	126 52	150 90	97
98	75 06	63 00	82 23	116 79	127 93	152 46	98
99	75 43	63 64	83 07	117 98	129 23	154 01	99
100	76 60	64 28	83 91	119 17	130 54	155 57	100



Numbers	Sines		Tangents		Secants		Numbers
	Degrees		Degrees		Degrees		
	41	49	41	49	41	49	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
1	00 75	00 66	00 87	01 15	01 32	01 52	1
2	01 51	01 31	01 74	02 30	02 05	02 05	2
3	02 25	01 97	02 61	03 45	03 57	04 57	3
4	03 02	02 62	03 48	04 60	05 30	05 10	4
5	03 77	03 28	04 35	05 75	06 62	07 62	5
6	04 53	03 94	05 22	06 90	07 95	09 15	6
7	05 28	04 59	06 09	08 05	09 27	10 56	7
8	05 04	05 25	06 35	09 20	10 17	12 19	8
9	06 79	06 90	07 32	10 35	11 92	13 72	9
10	07 55	06 56	08 69	11 50	13 25	15 24	10
11	08 30	07 21	09 56	12 65	14 57	16 77	11
12	09 06	07 08	10 43	13 40	15 09	18 29	12
13	09 51	08 17	11 30	14 95	17 22	19 82	13
14	10 57	09 18	12 17	16 10	18 55	21 34	14
15	11 32	09 84	13 04	17 25	19 87	22 87	15
16	12 08	10 49	13 91	18 40	21 20	24 39	16
17	12 83	11 05	14 07	19 55	22 05	25 92	17
18	13 59	11 30	15 05	20 70	23 55	27 44	18
19	14 34	12 46	16 52	21 08	25 17	28 97	19
20	15 09	13 12	17 39	23 01	26 50	30 48	20
21	15 86	13 78	18 26	24 16	27 82	32 02	21
22	16 61	14 04	19 03	25 31	29 05	33 54	22
23	17 36	15 09	19 50	26 46	30 47	35 27	23
24	18 11	15 75	20 77	27 61	31 80	36 59	24
25	18 87	16 49	21 64	28 76	33 12	38 12	25
26	19 63	17 06	22 51	29 91	34 45	39 64	26
27	20 38	17 07	23 38	31 06	35 07	41 17	27
28	21 13	18 37	24 25	32 21	37 10	42 69	28
29	21 89	19 03	25 12	33 36	38 42	44 02	29
30	22 64	19 63	26 08	34 51	39 75	45 73	30
31	23 40	20 33	26 95	35 66	41 07	47 26	31
32	24 15	20 99	27 82	36 81	42 04	48 79	32
33	24 51	21 65	28 69	37 96	43 02	50 31	33
34	25 05	22 30	29 56	39 11	45 05	51 84	34
35	26 42	22 96	30 43	40 26	45 37	53 36	35
36	27 17	23 61	31 30	41 41	47 70	54 89	36
37	27 93	24 27	32 17	42 56	49 02	56 41	37
38	28 68	24 93	33 04	43 71	50 35	57 94	38
39	29 44	25 58	33 51	44 85	51 57	59 45	39
40	30 19	26 24	34 77	46 02	53 00	60 97	40
41	30 96	26 89	35 64	47 17	54 32	62 50	41
42	31 70	27 55	36 51	48 32	55 05	64 03	42
43	32 46	28 20	37 38	49 47	56 09	65 55	43
44	33 21	28 86	38 25	50 62	58 30	67 08	44
45	33 68	29 51	39 12	51 77	59 62	68 60	45
46	34 72	30 17	40 09	52 92	60 95	70 13	46
47	35 43	30 83	40 56	54 07	62 07	71 65	47
48	36 34	31 48	41 43	55 22	63 60	73 18	48
49	36 59	32 14	42 30	56 37	64 92	74 70	49
50	37 74	32 80	43 47	57 52	66 25	75 22	50

Numbers	Sines Degrees			Tangents Degrees			Secants Degrees		Numbers
	41	49		41	49		41	49	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	38 50	33 46		44 33	58 67		67 57	77 74	51
52	39 25	34 12		45 20	59 82		68 30	79 26	52
53	40 01	34 58		46 07	60 97		70 22	80 79	53
54	40 36	35 43		46 49	62 12		71 55	82 31	54
55	41 52	36 09		47 81	63 27		72 87	83 84	55
56	42 27	36 75		48 68	64 42		74 20	85 36	56
57	43 03	37 04		49 55	65 57		75 52	86 89	57
58	43 38	37 38		50 42	66 72		76 35	88 21	58
59	44 04	38 07		51 29	67 87		78 17	89 91	59
60	45 23	39 37		52 16	69 02		79 50	91 46	60
61	46 05	40 03		53 02	70 17		80 83	92 98	61
62	46 40	40 33		53 49	71 32		82 15	94 50	62
63	47 16	41 03		54 36	72 47		83 47	96 03	63
64	48 01	41 33		55 23	73 62		84 30	97 15	64
65	49 07	42 05		56 10	74 77		86 12	99 08	65
66	49 52	43 30		57 37	75 92		87 45	100 60	66
67	50 38	43 56		58 24	77 08		88 31	102 13	67
68	51 23	44 26		59 11	78 23		90 10	103 65	68
69	52 08	45 27		59 58	79 38		91 42	105 18	69
70	52 54	45 93		60 45	80 53		92 75	106 70	70
71	53 40	46 58		61 31	81 68		94 07	108 22	71
72	54 25	47 24		62 18	82 83		95 40	109 74	72
73	55 10	47 59		63 04	83 98		96 32	111 26	73
74	55 56	48 55		64 50	85 13		98 05	112 79	74
75	56 42	49 20		65 36	86 38		99 37	114 31	75
76	57 27	49 86		66 22	87 43		100 70	115 84	76
77	58 12	50 51		67 08	88 58		102 10	117 36	77
78	58 58	51 17		67 54	89 73		103 35	118 89	78
79	59 43	51 43		68 40	90 88		104 67	120 41	79
80	60 29	52 19		69 26	92 03		106 00	121 94	80
81	61 14	53 15		70 11	93 18		107 32	123 46	81
82	61 59	53 40		71 57	94 33		108 55	124 98	82
83	62 44	54 46		72 42	95 48		109 57	126 50	83
84	63 29	55 12		73 27	96 63		111 30	128 03	84
85	64 16	55 87		74 12	97 78		112 62	129 55	85
86	64 53	56 43		75 57	98 93		113 95	131 08	86
87	65 39	57 09		76 42	100 08		115 27	132 60	87
88	66 25	57 35		77 27	101 23		116 50	134 13	88
89	67 10	58 40		78 12	102 38		117 52	135 65	89
90	67 56	59 05		79 57	103 54		119 25	137 19	90
91	68 41	59 71		80 42	104 69		120 57	138 71	91
92	69 26	60 37		81 27	105 84		121 50	140 23	92
93	70 11	61 03		82 12	106 99		123 02	141 75	93
94	70 56	61 68		83 57	108 14		124 55	143 27	94
95	71 41	62 33		84 42	109 39		125 87	144 80	95
96	72 27	62 99		85 27	110 44		127 20	146 32	96
97	73 12	63 65		86 12	111 59		128 52	147 85	97
98	73 58	64 30		87 57	112 74		129 85	149 37	98
99	74 43	64 96		88 42	113 89		131 17	150 50	99
100	75 29	65 61		89 27	115 04		132 50	152 43	100

3 Rhumb and three quarters is 42 deg. 11 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	42	48		42	48		42	48	
1	N. pts.	N. pts.	1	N. pts.	N. pts.	1	N. pts.	N. pts.	1
2	00 74	00 67	2	01 08	01 11	2	01 35	01 49	2
3	01 49	01 34	3	02 22	02 22	3	02 69	02 99	3
4	02 23	02 01	4	03 03	03 33	4	03 04	03 48	4
5	02 98	02 68	5	03 40	04 44	5	03 38	05 98	5
6	03 72	03 35	6	04 50	05 55	6	06 73	07 47	6
7	04 46	04 01	7	05 40	06 66	7	08 07	08 97	7
8	05 20	04 68	8	06 22	07 77	8	09 42	10 46	8
9	05 54	05 35	9	07 05	08 83	9	10 76	11 96	9
10	06 28	06 02	10	07 48	09 03	10	12 11	13 45	10
11	07 02	06 69	11	08 31	10 11	11	13 46	14 94	11
12	07 43	07 36	12	09 20	12 22	12	14 80	16 44	12
13	08 24	08 02	13	10 08	13 33	13	16 15	17 93	13
14	09 05	08 69	14	10 50	14 44	14	17 04	19 43	14
15	09 46	09 36	15	11 32	15 55	15	18 04	20 92	15
16	10 27	10 04	16	12 15	16 66	16	20 18	22 42	16
17	11 08	10 70	17	13 00	17 77	17	21 53	23 91	17
18	11 49	11 37	18	13 43	18 83	18	22 37	25 41	18
19	12 30	12 04	19	14 27	19 09	19	23 22	26 40	19
20	13 11	12 71	20	15 11	20 19	20	24 07	28 40	20
21	13 52	13 38	21	16 00	21 21	21	25 57	29 89	21
22	14 33	14 05	22	16 49	22 32	22	26 91	31 38	22
23	15 14	14 52	23	17 38	23 43	23	27 46	32 68	23
24	15 55	15 39	24	18 27	24 54	24	28 59	33 97	24
25	16 36	16 06	25	19 16	25 65	25	30 12	35 87	25
26	17 17	16 73	26	20 05	26 76	26	31 27	37 36	26
27	17 58	17 49	27	20 54	27 87	27	32 42	38 86	27
28	18 39	18 07	28	21 43	28 98	28	33 57	40 35	28
29	19 20	18 74	29	22 32	29 10	29	35 08	41 85	29
30	20 01	19 40	30	23 21	30 21	30	36 19	43 34	30
31	20 42	20 07	31	24 10	31 31	31	37 30	44 83	31
32	21 23	20 74	32	25 00	32 43	32	38 41	46 33	32
33	22 04	21 41	33	25 49	33 54	33	39 50	47 82	33
34	22 45	22 08	34	26 38	34 65	34	40 59	49 32	34
35	23 26	22 75	35	27 27	35 76	35	42 08	50 81	35
36	24 07	23 41	36	28 16	36 87	36	43 17	52 31	36
37	24 48	24 08	37	29 05	37 98	37	44 26	53 81	37
38	25 29	24 75	38	29 54	38 19	38	45 35	55 30	38
39	26 10	25 42	39	30 43	39 30	39	46 44	56 80	39
40	26 51	26 09	40	31 32	40 41	40	47 53	58 29	40
41	27 32	26 76	41	32 21	41 52	41	48 62	59 78	41
42	28 13	27 42	42	33 10	42 63	42	49 71	61 28	42
43	28 54	28 09	43	34 00	43 74	43	50 80	62 77	43
44	29 35	28 76	44	34 49	44 85	44	51 89	64 26	44
45	30 16	29 43	45	35 38	45 96	45	52 98	65 75	45
46	30 57	30 10	46	36 27	46 07	46	54 07	67 24	46
47	31 38	30 77	47	37 16	47 18	47	55 16	68 73	47
48	32 19	31 44	48	38 05	48 29	48	56 25	70 22	48
49	33 00	32 11	49	38 54	49 40	49	57 34	71 71	49
50	33 41	32 78	50	39 43	50 51	50	58 43	73 20	50
51	34 22	33 45	51	40 32	51 62	51	59 52	74 69	51
52	35 03	34 12	52	41 21	52 73	52	60 61	76 18	52
53	35 44	34 79	53	42 10	53 84	53	61 70	77 67	53
54	36 25	35 46	54	43 00	54 95	54	62 79	79 16	54
55	37 06	36 13	55	43 49	55 06	55	63 88	80 65	55
56	37 47	36 80	56	44 38	56 17	56	64 97	82 14	56
57	38 28	37 47	57	45 27	57 28	57	66 06	83 63	57
58	39 09	38 14	58	46 16	58 39	58	67 15	85 12	58
59	39 50	38 81	59	47 05	59 50	59	68 24	86 61	59
60	40 31	39 48	60	47 54	60 61	60	69 33	88 10	60
61	41 12	40 15	61	48 43	61 72	61	70 42	89 59	61
62	41 53	40 82	62	49 32	62 83	62	71 51	91 08	62
63	42 34	41 49	63	50 21	63 94	63	72 60	92 57	63
64	43 15	42 16	64	51 10	64 05	64	73 69	94 06	64
65	43 56	42 83	65	52 00	65 16	65	74 78	95 55	65
66	44 37	43 50	66	52 49	66 27	66	75 87	97 04	66
67	45 18	44 17	67	53 38	67 38	67	76 96	98 13	67
68	45 99	44 84	68	54 27	68 49	68	77 05	99 22	68
69	46 40	45 51	69	55 16	69 60	69	78 14	100 31	69
70	47 21	46 18	70	56 05	70 71	70	79 23	101 40	70
71	48 02	46 85	71	56 54	71 82	71	80 32	102 49	71
72	48 43	47 52	72	57 43	72 93	72	81 41	103 58	72
73	49 24	48 19	73	58 32	73 04	73	82 50	104 67	73
74	50 05	48 86	74	59 21	74 15	74	83 59	105 76	74
75	50 46	49 53	75	60 10	75 26	75	84 68	106 85	75
76	51 27	50 20	76	61 00	76 37	76	85 77	107 94	76
77	52 08	50 87	77	61 49	77 48	77	86 86	109 03	77
78	52 49	51 54	78	62 38	78 59	78	87 95	110 12	78
79	53 30	52 21	79	63 27	79 70	79	89 04	111 21	79
80	54 11	52 88	80	64 16	80 81	80	90 13	112 30	80
81	54 52	53 55	81	65 05	81 92	81	91 22	113 39	81
82	55 33	54 22	82	65 54	82 03	82	92 31	114 48	82
83	56 14	54 89	83	66 43	83 14	83	93 40	115 57	83
84	56 55	55 56	84	67 32	84 25	84	94 49	116 66	84
85	57 36	56 23	85	68 21	85 36	85	95 58	117 75	85
86	58 17	56 90	86	69 10	86 47	86	96 67	118 84	86
87	58 98	57 57	87	70 00	87 58	87	97 76	119 93	87
88	59 39	58 24	88	70 49	88 69	88	98 85	121 02	88
89	60 20	58 91	89	71 38	89 80	89	99 94	122 11	89
90	61 01	59 58	90	72 27	90 91	90	101 03	123 20	90
91	61 82	60 25	91	73 16	91 02	91	102 12	124 29	91
92	62 63	60 92	92	74 05	92 13	92	103 21	125 38	92
93	63 44	61 59	93	74 54	93 24	93	104 30	126 47	93
94	64 25	62 26	94	75 43	94 35	94	105 39	127 56	94
95	65 06	62 93	95	76 32	95 46	95	106 48	128 65	95
96	65 87	63 60	96	77 21	96 57	96	107 57	129 74	96
97	66 68	64 27	97	78 10	97 08	97	108 66	130 83	97
98	67 49	64 94	98	79 00	98 19	98	109 75	131 92	98
99	68 30	65 61	99	79 49	99 30	99	110 84	133 01	99
100	69 11	66 28	100	80 38	100 41	100	111 93	134 10	100

4 Rhumb and a quarter is 47 deg. 49 min.

4 Rhumb and a quarter is 47 deg. 49 min.

3 Rhumb and three quarters is 42 deg. 11 min.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	42	48		42	48		42	48	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	37 60	34 12	45	62	56 64	65	62	75 22	51
52	38 24	34 07 79	46	1 82	57 2 75	66	1 97	76 21	52
53	39 39	35 46	47	7 22	58 1 85	67	1 31	77 21	53
54	40 13	36 13	48	7 62	59 2 97	68	1 56	80 1 71	54
55	40 87	36 80	49	52	61 03	69	2 00	81 25	55
56	41 61	37 47	50	42	62 19	70	3 35	83 70	56
57	42 35	38 14	51	1 32	63 30	71	1 69	84 19	57
58	43 10	38 81	52	2 22	64 41	72	2 04	85 69	58
59	43 84	39 48	53	3 12	65 52	73	2 38	86 18	59
60	44 59	40 15	54	4 02	66 64	74	3 11	87 67	60
61	45 33	40 82	55	4 52	67 75	75	3 45	88 67	61
62	46 07	41 49	56	5 42	68 85	76	4 19	89 67	62
63	46 31	42 16	57	6 32	69 97	77	4 53	90 66	63
64	47 55	42 81	58	7 22	70 108	78	5 27	91 65	64
65	48 30	43 50	59	8 12	71 119	79	6 01	92 64	65
66	49 04	44 17	60	9 02	72 129	80	6 35	93 63	66
67	49 79	44 84	61	9 52	73 30	81	7 09	94 62	67
68	50 53	45 50	62	10 42	74 41	82	7 43	95 61	68
69	51 27	46 17	63	11 32	75 52	83	8 17	96 60	69
70	52 02	46 84	64	12 22	76 63	84	8 51	97 59	70
71	52 76	47 51	65	13 12	77 74	85	9 25	98 58	71
72	53 51	48 18	66	14 02	78 85	86	9 59	99 57	72
73	54 25	48 85	67	14 52	79 96	87	10 33	100 56	73
74	55 00	49 52	68	15 42	80 107	88	11 07	101 55	74
75	55 74	50 19	69	16 32	81 118	89	11 41	102 54	75
76	56 49	50 86	70	17 22	82 129	90	12 15	103 53	76
77	57 23	51 53	71	18 12	83 140	91	12 49	104 52	77
78	57 98	52 20	72	19 02	84 151	92	13 23	105 51	78
79	58 72	52 87	73	19 52	85 162	93	13 57	106 50	79
80	59 45	53 53	74	20 42	86 173	94	14 31	107 49	80
81	60 20	54 20	75	21 32	87 184	95	15 05	108 48	81
82	60 94	54 87	76	22 22	88 195	96	15 39	109 47	82
83	61 69	55 54	77	23 12	89 206	97	16 13	110 46	83
84	62 43	56 21	78	24 02	90 217	98	16 47	111 45	84
85	63 18	56 88	79	24 52	91 228	99	17 21	112 44	85
86	63 92	57 55	80	25 42	92 239	100	17 55	113 43	86
87	64 66	58 22	81	26 32	93 250			114 42	87
88	65 40	58 89	82	27 22	94 261			115 41	88
89	66 14	59 56	83	28 12	95 272			116 40	89
90	66 88	60 22	84	29 02	96 283			117 39	90
91	67 63	60 89	85	29 52	97 294			118 38	91
92	68 37	61 56	86	30 42	98 305			119 37	92
93	69 12	62 23	87	31 32	99 316			120 36	93
94	69 86	62 50	88	32 22	100 327			121 35	94
95	70 60	63 57	89	33 12	101 338			122 34	95
96	71 34	64 24	90	34 02	102 349			123 33	96
97	72 09	64 51			103 360			124 32	97
98	72 83	65 28			104 371			125 31	98
99	73 58	66 25			105 382			126 30	99
100	74 31	66 51			106 393			127 29	100

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	43	47		43	47		43	47	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 00	00 00	1	00 00	01 00	1	01 37	01 47	1
2	01 01	01 01	2	01 01	02 14	2	02 07	02 19	2
3	02 02	02 02	3	02 02	03 22	3	03 10	03 24	3
4	03 03	03 03	4	03 03	04 29	4	04 17	04 33	4
5	04 04	04 04	5	04 04	05 36	5	05 05	05 23	5
6	05 05	05 05	6	05 05	06 43	6	06 15	06 35	6
7	06 06	06 06	7	06 06	07 51	7	07 25	07 48	7
8	07 07	07 07	8	07 07	08 58	8	08 33	09 08	8
9	08 08	08 08	9	08 08	09 65	9	09 41	10 18	9
10	09 09	09 09	10	09 09	10 72	10	10 49	11 28	10
11	10 10	10 10	11	10 10	11 79	11	11 57	12 39	11
12	11 11	11 11	12	11 11	12 87	12	12 66	13 48	12
13	12 12	12 12	13	12 12	13 94	13	13 75	14 59	13
14	13 13	13 13	14	13 13	14 03	14	14 86	15 21	14
15	14 14	14 14	15	14 14	15 08	15	15 91	16 28	15
16	15 15	15 15	16	15 15	16 16	16	16 98	17 37	16
17	16 16	16 16	17	16 16	17 23	17	17 11	18 44	17
18	17 17	17 17	18	17 17	18 30	18	18 19	19 59	18
19	18 18	18 18	19	18 18	19 37	19	19 29	21 00	19
20	19 19	19 19	20	19 19	20 45	20	20 22	22 03	20
21	20 20	20 20	21	20 20	21 52	21	21 31	23 08	21
22	21 21	21 21	22	21 21	22 59	22	22 41	24 15	22
23	22 22	22 22	23	22 22	23 66	23	23 44	25 24	23
24	23 23	23 23	24	23 23	24 38	24	24 43	26 35	24
25	24 24	24 24	25	24 24	25 51	25	25 48	27 48	25
26	25 25	25 25	26	25 25	26 81	26	26 47	28 63	26
27	26 26	26 26	27	26 26	27 88	27	27 55	29 80	27
28	27 27	27 27	28	27 27	28 59	28	28 63	30 98	28
29	28 28	28 28	29	28 28	29 03	29	29 68	32 18	29
30	29 29	29 29	30	29 29	30 10	30	30 74	33 40	30
31	30 30	30 30	31	30 30	31 17	31	31 81	34 64	31
32	31 31	31 31	32	31 31	32 24	32	32 89	35 51	32
33	32 32	32 32	33	32 32	33 32	33	33 96	36 41	33
34	33 33	33 33	34	33 33	34 39	34	34 103	37 35	34
35	34 34	34 34	35	34 34	35 46	35	35 111	38 28	35
36	35 35	35 35	36	35 35	36 53	36	36 119	39 18	36
37	36 36	36 36	37	36 36	37 58	37	37 127	40 05	37
38	37 37	37 37	38	37 37	38 61	38	38 135	40 89	38
39	38 38	38 38	39	38 38	39 68	39	39 143	41 70	39
40	39 39	39 39	40	39 39	40 75	40	40 151	42 49	40
41	40 40	40 40	41	40 40	41 82	41	41 159	43 25	41
42	41 41	41 41	42	41 41	42 89	42	42 167	44 00	42
43	42 42	42 42	43	42 42	43 97	43	43 175	44 72	43
44	43 43	43 43	44	43 43	44 04	44	44 183	45 42	44
45	44 44	44 44	45	44 44	45 11	45	45 191	46 10	45
46	45 45	45 45	46	45 45	46 18	46	46 200	46 35	46
47	46 46	46 46	47	46 46	47 26	47	47 208	47 00	47
48	47 47	47 47	48	47 47	48 33	48	48 217	47 55	48
49	48 48	48 48	49	48 48	49 40	49	49 225	48 40	49
50	49 49	49 49	50	49 49	50 47	50	50 234	49 15	50

Numbers	Sines Degrees			Tangents Degrees			Secants. Degrees.		Numbers
	43	47		43	47		43	47	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
51	37 30	34 78		47 57	54 69		09 73	74 79	51
52	38 03	35 04		48 15	55 26		71 10	76 05	52
53	38 77	36 14		48 43	56 04		72 17	77 02	53
54	39 50	36 52		50 17	57 01		73 14	79 19	54
55	40 23	37 50		51 30	58 08		75 20	80 65	55
56	40 56	38 18		52 22	60 05		76 57	82 12	56
57	41 29	38 47		53 16	61 13		77 54	83 19	57
58	42 02	39 15		54 09	62 20		79 01	85 05	58
59	42 35	40 23		55 02	63 27		80 13	86 12	59
60	43 88	40 52		55 55	64 34		81 04	87 08	60
61	44 61	41 69		56 88	65 42		82 41	89 45	61
62	45 34	42 28		57 82	66 49		83 17	90 52	62
63	46 07	43 06		58 75	67 56		84 14	92 18	63
64	46 51	43 54		59 68	68 53		85 11	93 15	64
65	47 54	44 32		60 62	69 71		86 08	94 12	65
66	48 27	45 01		61 55	70 78		90 24	96 78	66
67	49 00	45 59		62 48	71 08		91 51	98 24	67
68	49 53	46 37		63 41	72 09		92 58	99 21	68
69	50 46	47 06		64 35	73 09		94 05	101 18	69
70	51 19	47 74		65 28	75 07		95 71	102 64	70
71	51 53	48 42		66 21	76 14		97 08	104 11	71
72	52 26	49 10		67 14	77 22		98 14	105 58	72
73	53 00	49 58		68 07	78 29		99 21	107 04	73
74	54 02	50 46		69 00	79 36		101 18	108 51	74
75	54 85	51 14		69 53	80 43		102 55	109 97	75
76	55 58	51 82		70 86	81 51		103 52	111 44	76
77	56 31	52 50		71 30	82 58		105 28	112 50	77
78	57 04	53 58		72 23	83 65		106 55	114 47	78
79	57 78	54 57		73 16	84 72		108 02	115 54	79
80	58 51	55 56		74 60	85 79		109 39	117 30	80
81	59 24	56 24		75 53	86 87		110 75	118 77	81
82	59 57	57 02		76 46	87 54		112 12	120 23	82
83	60 30	57 50		77 39	89 01		113 49	121 70	83
84	61 03	58 38		78 33	90 08		114 86	123 17	84
85	62 16	59 06		79 26	91 16		116 22	124 63	85
86	62 59	59 64		80 19	92 23		117 59	126 10	86
87	63 33	60 32		81 12	93 30		119 05	127 57	87
88	64 06	61 01		82 05	94 37		120 33	129 03	88
89	64 59	61 60		82 59	95 45		121 69	130 50	89
90	65 52	62 38		83 53	96 51		123 06	131 95	90
91	66 55	63 06		84 48	97 59		124 43	133 43	91
92	67 28	63 74		85 42	98 66		125 59	134 50	92
93	68 01	64 42		86 37	99 74		127 16	136 06	93
94	68 75	65 10		87 31	100 81		128 53	137 13	94
95	69 48	65 78		88 26	101 88		129 50	139 30	95
96	70 21	66 46		89 22	102 55		131 06	140 77	96
97	70 54	67 14		90 17	104 03		132 53	142 23	97
98	71 27	67 52		91 13	105 10		134 00	143 70	98
99	72 00	68 20		92 08	106 17		135 37	145 17	99
100	73 13	69 20		93 25	107 24		136 73	146 63	100



Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	44	46		44	46		44	46	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00 72	00 69	1	00 97	01 04	1	01 39	01 11	1
2	01 44	01 39	2	01 59	02 07	2	02 78	02 58	2
3	02 16	02 08	3	02 30	03 11	3	04 17	04 32	3
4	02 48	02 38	4	03 04	04 14	4	05 56	05 76	4
5	03 20	03 17	5	04 18	05 18	5	06 95	07 20	5
6	04 32	04 17	6	05 21	06 21	6	08 34	08 61	6
7	05 04	04 56	7	06 25	07 25	7	09 40	10 08	7
8	05 36	05 26	8	07 29	08 29	8	11 12	11 52	8
9	06 07	05 55	9	08 32	09 32	9	12 51	12 35	9
10	06 39	06 25	10	09 36	10 36	10	13 29	14 40	10
11	07 11	07 04	11	10 40	11 39	11	15 29	15 83	11
12	07 43	07 34	12	11 43	12 43	12	16 08	17 27	12
13	08 15	08 03	13	12 46	13 46	13	18 07	18 71	13
14	08 47	08 33	14	13 50	14 50	14	19 46	20 15	14
15	09 19	09 04	15	14 53	15 53	15	20 85	21 59	15
16	10 31	10 12	16	15 57	16 57	16	22 24	23 03	16
17	11 03	10 41	17	16 59	17 59	17	23 06	24 47	17
18	11 35	11 11	18	17 62	18 62	18	24 02	25 51	18
19	12 07	11 42	19	18 35	19 35	19	25 31	27 35	19
20	12 39	12 13	20	19 38	20 38	20	26 50	28 79	20
21	13 11	12 44	21	20 41	21 41	21	27 80	29 23	21
22	13 43	13 15	22	21 44	22 44	22	29 19	30 23	22
23	14 15	13 46	23	22 47	23 47	23	30 58	31 67	23
24	14 47	14 17	24	23 50	24 50	24	31 37	33 11	24
25	15 19	14 48	25	24 53	25 53	25	32 16	34 55	25
26	15 51	15 19	26	25 56	26 56	26	33 36	35 99	26
27	16 23	15 50	27	26 59	27 59	27	34 75	37 43	27
28	16 55	16 21	28	27 62	28 62	28	36 14	38 87	28
29	17 27	16 52	29	28 65	29 65	29	37 03	39 51	29
30	17 59	17 23	30	29 68	30 68	30	38 52	40 31	30
31	18 31	17 54	31	30 71	31 71	31	40 41	41 75	31
32	19 03	18 25	32	31 74	32 74	32	41 71	43 19	32
33	19 35	18 56	33	32 77	33 77	33	43 10	44 63	33
34	20 07	19 27	34	33 80	34 80	34	44 04	45 07	34
35	20 39	19 58	35	34 83	35 83	35	45 54	46 51	35
36	21 11	20 29	36	35 86	36 86	36	47 27	48 09	36
37	21 43	21 00	37	36 89	37 89	37	48 66	50 39	37
38	22 15	21 31	38	37 92	38 92	38	50 05	51 82	38
39	22 47	22 02	39	38 95	39 95	39	51 04	52 26	39
40	23 19	22 33	40	39 98	40 98	40	52 03	53 40	40
41	23 51	23 03	41	40 01	41 01	41	53 12	54 70	41
42	24 23	23 33	42	41 04	42 04	42	54 22	55 14	42
43	24 55	24 04	43	42 07	43 07	43	55 61	57 58	43
44	25 27	24 35	44	43 10	44 10	44	57 00	59 02	44
45	25 59	25 06	45	44 13	45 13	45	58 19	60 16	45
46	26 31	25 37	46	45 16	46 16	46	59 08	61 31	46
47	27 03	26 08	47	46 19	47 19	47	60 17	62 46	47
48	27 35	26 39	48	47 22	48 22	48	61 17	63 34	48
49	28 07	27 10	49	48 25	49 25	49	62 56	64 78	49
50	28 39	27 41	50	49 28	50 28	50	63 55	66 22	50
				50 31	51 31		65 14	67 36	51
				51 34	52 34		66 13	69 10	52
				52 37	53 37		67 12	70 54	53
				53 40	54 40		68 11	71 58	54
				54 43	55 43		69 10		55
				55 46	56 46				
				56 49	57 49				
				57 52	58 52				
				58 55	59 55				
				59 58	60 58				
				60 61	61 61				
				61 64	62 64				
				62 67	63 67				
				63 70	64 70				
				64 73	65 73				
				65 76	66 76				
				66 79	67 79				
				67 82	68 82				
				68 85	69 85				
				69 88	70 88				
				70 91	71 91				
				71 94	72 94				
				72 97	73 97				
				73 100	74 100				

Numbers	Sines Degrees		Tangents Degrees		Secants Degrees		Numbers
	44	46	44	46	44	46	
	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	N. pts.	
51	36 69	35 43	49 25	52 81	70 90	73 42	51
52	37 40	36 12	50 21	53 85	72 26	74 36	52
53	38 12	35 82	51 08	54 83	73 68	75 30	53
54	38 08	37 51	52 14	55 92	75 07	77 74	54
55	39 56	38 21	53 11	56 96	76 45	79 18	55
56	40 28	38 90	54 07	57 99	77 85	80 62	56
57	41 00	39 06	55 04	59 03	79 24	82 06	57
58	41 72	40 29	56 01	60 07	80 63	83 50	58
59	42 44	40 99	56 07	61 10	82 02	84 94	59
60	43 16	41 68	57 94	62 13	83 41	86 38	60
61	43 88	42 37	58 99	63 17	84 80	87 81	61
62	44 60	43 07	59 87	64 20	86 19	89 25	62
63	45 32	43 76	60 84	65 24	87 58	90 69	63
64	46 04	44 46	61 08	66 27	89 37	92 13	64
65	46 76	45 15	62 77	67 31	90 36	93 57	65
66	47 48	45 85	63 74	68 34	91 75	95 01	66
67	48 20	46 54	64 70	69 38	93 14	96 45	67
68	48 92	47 24	65 67	70 42	94 53	97 89	68
69	49 63	47 93	66 64	71 45	95 92	99 33	69
70	50 35	48 63	67 60	72 48	97 31	100 77	70
71	51 07	49 32	68 56	73 52	98 70	102 21	71
72	51 79	50 02	69 53	74 56	100 09	103 65	72
73	52 51	50 71	70 49	75 59	101 48	104 09	73
74	53 23	51 41	71 45	76 63	102 87	106 53	74
75	53 95	52 10	72 42	77 67	104 26	107 97	75
76	54 67	52 80	73 39	78 70	105 65	109 41	76
77	55 39	53 49	74 36	79 73	107 04	110 85	77
78	56 11	54 19	75 32	80 77	108 43	112 29	78
79	56 83	54 88	76 29	81 80	109 82	113 73	79
80	57 55	55 57	77 26	82 84	111 22	115 17	80
81	58 27	56 27	78 22	83 88	112 61	116 61	81
82	58 99	56 56	79 19	84 92	114 00	118 05	82
83	59 70	57 06	80 15	85 96	115 39	119 49	83
84	60 42	58 35	81 12	86 99	116 78	120 93	84
85	61 14	59 05	82 08	88 03	118 17	122 37	85
86	61 86	59 74	83 05	89 07	119 56	123 80	86
87	62 58	60 44	84 02	90 10	120 95	125 24	87
88	63 30	61 13	85 08	91 13	122 34	126 69	88
89	64 02	61 83	86 94	92 16	123 73	128 12	89
90	64 74	62 52	87 92	93 19	125 12	129 56	90
91	65 46	63 21	88 87	94 23	126 51	131 00	91
92	66 18	63 91	89 84	95 25	127 90	132 44	92
93	66 90	64 60	90 80	96 30	129 29	133 88	93
94	67 62	65 30	91 77	97 33	130 68	135 32	94
95	68 34	65 99	92 74	98 37	132 07	136 76	95
96	69 05	66 69	93 70	99 40	133 46	138 20	96
97	69 78	67 38	94 67	100 44	134 85	139 64	97
98	70 50	68 08	95 64	101 47	136 24	141 08	98
99	71 21	68 77	96 60	102 51	137 63	142 52	99
100	71 93	69 47	97 57	103 55	139 02	143 96	100

4 Rhumb is 45 deg.

4 Rhumb is 45 deg.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants Degrees		Numbers
	45	45		45	45		45	45	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	00	00	1	01	01	1	01	01	1
2	01	01	2	02	02	2	02	02	2
3	02	02	3	03	03	3	03	03	3
4	03	03	4	04	04	4	04	04	4
5	04	04	5	05	05	5	05	05	5
6	05	05	6	06	06	6	06	06	6
7	06	06	7	07	07	7	07	07	7
8	07	07	8	08	08	8	08	08	8
9	08	08	9	09	09	9	09	09	9
10	09	09	10	10	10	10	10	10	10
11	10	10	11	11	11	11	11	11	11
12	11	11	12	12	12	12	12	12	12
13	12	12	13	13	13	13	13	13	13
14	13	13	14	14	14	14	14	14	14
15	14	14	15	15	15	15	15	15	15
16	15	15	16	16	16	16	16	16	16
17	16	16	17	17	17	17	17	17	17
18	17	17	18	18	18	18	18	18	18
19	18	18	19	19	19	19	19	19	19
20	19	19	20	20	20	20	20	20	20
21	20	20	21	21	21	21	21	21	21
22	21	21	22	22	22	22	22	22	22
23	22	22	23	23	23	23	23	23	23
24	23	23	24	24	24	24	24	24	24
25	24	24	25	25	25	25	25	25	25
26	25	25	26	26	26	26	26	26	26
27	26	26	27	27	27	27	27	27	27
28	27	27	28	28	28	28	28	28	28
29	28	28	29	29	29	29	29	29	29
30	29	29	30	30	30	30	30	30	30
31	30	30	31	31	31	31	31	31	31
32	31	31	32	32	32	32	32	32	32
33	32	32	33	33	33	33	33	33	33
34	33	33	34	34	34	34	34	34	34
35	34	34	35	35	35	35	35	35	35
36	35	35	36	36	36	36	36	36	36
37	36	36	37	37	37	37	37	37	37
38	37	37	38	38	38	38	38	38	38
39	38	38	39	39	39	39	39	39	39
40	39	39	40	40	40	40	40	40	40
41	40	40	41	41	41	41	41	41	41
42	41	41	42	42	42	42	42	42	42
43	42	42	43	43	43	43	43	43	43
44	43	43	44	44	44	44	44	44	44
45	44	44	45	45	45	45	45	45	45
46	45	45	46	46	46	46	46	46	46
47	46	46	47	47	47	47	47	47	47
48	47	47	48	48	48	48	48	48	48
49	48	48	49	49	49	49	49	49	49
50	49	49	50	50	50	50	50	50	50

4 Rhumb is 45 deg.

Numbers	Sines Degrees		Numbers	Tangents Degrees		Numbers	Secants. Degrees.		Numbers
	45	45		45	45		45	45	
	N. pts.	N. pts.		N. pts.	N. pts.		N. pts.	N. pts.	
1	36 06	36 06	51	00 00	51 00	72	12 12	72 12	51
2	36 07	36 07	52	00 00	52 00	73	13 13	73 13	52
3	36 08	36 08	53	00 00	53 00	74	14 14	74 14	53
4	36 09	36 09	54	00 00	54 00	75	15 15	75 15	54
5	36 10	36 10	55	00 00	55 00	76	16 16	76 16	55
6	36 11	36 11	56	00 00	56 00	77	17 17	77 17	56
7	36 12	36 12	57	00 00	57 00	78	18 18	78 18	57
8	36 13	36 13	58	00 00	58 00	79	19 19	79 19	58
9	36 14	36 14	59	00 00	59 00	80	20 20	80 20	59
10	36 15	36 15	60	00 00	60 00	81	21 21	81 21	60
11	36 16	36 16	61	00 00	61 00	82	22 22	82 22	61
12	36 17	36 17	62	00 00	62 00	83	23 23	83 23	62
13	36 18	36 18	63	00 00	63 00	84	24 24	84 24	63
14	36 19	36 19	64	00 00	64 00	85	25 25	85 25	64
15	36 20	36 20	65	00 00	65 00	86	26 26	86 26	65
16	36 21	36 21	66	00 00	66 00	87	27 27	87 27	66
17	36 22	36 22	67	00 00	67 00	88	28 28	88 28	67
18	36 23	36 23	68	00 00	68 00	89	29 29	89 29	68
19	36 24	36 24	69	00 00	69 00	90	30 30	90 30	69
20	36 25	36 25	70	00 00	70 00	91	31 31	91 31	70
21	36 26	36 26	71	00 00	71 00	92	32 32	92 32	71
22	36 27	36 27	72	00 00	72 00	93	33 33	93 33	72
23	36 28	36 28	73	00 00	73 00	94	34 34	94 34	73
24	36 29	36 29	74	00 00	74 00	95	35 35	95 35	74
25	36 30	36 30	75	00 00	75 00	96	36 36	96 36	75
26	36 31	36 31	76	00 00	76 00	97	37 37	97 37	76
27	36 32	36 32	77	00 00	77 00	98	38 38	98 38	77
28	36 33	36 33	78	00 00	78 00	99	39 39	99 39	78
29	36 34	36 34	79	00 00	79 00	100	40 40	100 40	79
30	36 35	36 35	80	00 00	80 00				80
31	36 36	36 36	81	00 00	81 00				81
32	36 37	36 37	82	00 00	82 00				82
33	36 38	36 38	83	00 00	83 00				83
34	36 39	36 39	84	00 00	84 00				84
35	36 40	36 40	85	00 00	85 00				85
36	36 41	36 41	86	00 00	86 00				86
37	36 42	36 42	87	00 00	87 00				87
38	36 43	36 43	88	00 00	88 00				88
39	36 44	36 44	89	00 00	89 00				89
40	36 45	36 45	90	00 00	90 00				90
41	36 46	36 46	91	00 00	91 00				91
42	36 47	36 47	92	00 00	92 00				92
43	36 48	36 48	93	00 00	93 00				93
44	36 49	36 49	94	00 00	94 00				94
45	36 50	36 50	95	00 00	95 00				95
46	36 51	36 51	96	00 00	96 00				96
47	36 52	36 52	97	00 00	97 00				97
48	36 53	36 53	98	00 00	98 00				98
49	36 54	36 54	99	00 00	99 00				99
50	36 55	36 55	100	00 00	100 00				100

4 Rhumb is 45 deg.

THE END OF THE CANON.



A  
Brief Canon  
O F  
TRIANGLES.

Or the Tables of

Sines, Tangents and Secants,  
in Natural Numbers : to every  
Degree, and each sixth Minute, or  
tenth Centesm of the Quadrant  
to the Radius of 10000.

To the which is added the Differ-  
ences, by which you may make them  
serve for any intermediate Minute or Centesm.

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By HENRY PHILIPS.

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*London, Printed by J. Gain, for W. Fisher at the Postern  
near Tower Hill, Tho. Passenger on London Bridge, and  
R. Smith under the Royal Exchange in Cornhill, 1684.*



# A Table of

		Sines.		Tangents.		Secants.			
M	P	o	90	o	Infinite	o	Infinite	P	M
0	0	0	10000	0	Infinite	10000	Infinite	100	0
06	10	17	9999	17	5729572	10000	5729581	90	54
12	20	35	9999	35	2864777	10000	2864795	80	48
18	30	52	9999	52	1909842	10000	1909868	70	42
24	40	70	9999	70	1432371	10000	1432406	60	36
30	50	87	9999	87	1145886	10000	1145930	50	30
36	60	105	9999	105	954895	10001	954947	40	24
42	70	122	9999	122	818470	10001	818531	30	18
48	80	140	9999	140	716151	10001	716220	20	12
54	90	157	9999	157	636567	10001	636646	10	06
60	100	174	9999	174	572900	10002	572987	0	0
		179	89		89		89		

		Sines.		Tangents.		Secants.			
M	P	1	91	1	1	1		P	M
0	0	174	9998	174	572900	10002	572987	100	60
06	10	192	9998	192	520806	10002	520903	90	54
12	20	209	9998	209	477395	10002	477500	80	48
18	30	227	9997	227	440661	10003	440775	70	42
24	40	244	9997	244	409174	10003	409296	60	36
30	50	262	9997	262	381885	10003	382016	50	30
36	60	279	9996	279	358005	10004	358145	40	24
42	70	297	9996	297	336935	10004	337084	30	18
48	80	314	9995	314	318205	10005	318362	20	12
54	90	332	9995	332	301446	10006	301612	10	06
60	100	349	9994	349	286362	10006	286537	0	0
		178	88		88		88		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	2	92	2		2		P	M
0	0	349	9994	349	286362	10006	286537	100	60
06	10	366	9993	367	272715	10007	272898	90	54
12	20	384	9993	384	260307	10007	260499	80	48
18	30	401	9992	402	248978	10008	249179	70	42
24	40	419	9991	419	238593	10009	238802	60	36
30	50	436	9990	437	229038	10009	229256	50	30
36	60	454	9990	454	220217	10010	220444	40	24
42	70	471	9989	472	212049	10011	212285	30	18
48	80	488	9988	489	204465	10012	204709	20	12
54	90	506	9987	507	297403	10013	197656	10	06
60	100	523	9986	524	190811	10014	191073	0	0
		177	87		87		87		

		Sines.		Tangents.		Secants.			
M	P	3	93	3		3		P	M
0	0	523	9986	524	190811	10014	191073	100	60
06	10	541	9985	542	184646	10015	184915	90	54
12	20	558	9984	559	178863	10016	179142	80	48
18	30	576	9983	577	173432	10017	173720	70	42
24	40	593	9982	594	168319	10018	168616	60	36
30	50	610	9981	612	163499	10019	163804	50	30
36	60	628	9980	629	158946	10020	159250	40	24
42	70	645	9979	646	154638	10021	154961	30	18
48	80	663	9978	664	150557	10022	150889	20	12
54	90	680	9977	682	146685	10023	147026	10	06
60	100	698	9976	699	143007	10024	143356	0	0
		176	86		86		86		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	4	94	4		4		P	M
0	0	608	9976	699	143007	10024	143356	100	60
06	10	715	9974	717	139507	10026	139865	90	54
12	20	732	Diff.	734	Diff.	10027	136541	80	48
18	30	750	9972	752	132996	10028	133371	70	42
24	40	767	9970	769	129962	10030	130346	60	36
30	50	785	9969	787	127062	10031	127455	50	30
36	60	802	9968	805	124288	10032	124690	40	24
42	70	819	9966	822	121632	10034	122043	30	18
48	80	837	9965	840	119087	10035	119510	20	12
54	90	854	9964	857	116645	10037	117073	10	06
60	100	872	9962	875	114301	10038	114737	0	0
		175	85		85		85		

		Sines.		Tangents.		Secants.			
M	P	5	95	4		5		P	M
0	0	872	9962	875	114302	10038	114737	100	60
06	10	889	9960	892	112018	10040	112493	90	54
12	20	906	9959	910	109882	10041	110838	80	48
18	30	924	9957	928	107797	10043	108260	70	42
24	40	941	9956	945	105789	10045	106261	60	36
30	50	958	9954	963	103854	10046	104334	50	30
36	60	976	9952	980	101988	10048	102477	40	24
42	70	993	9951	998	100187	10050	100685	30	18
48	80	1011	9949	1016	98448	10051	98955	20	12
54	90	1028	9947	1033	96768	10053	97283	10	06
60	100	1045	9945	1051	95144	10055	95668	0	0
		174	84		84		84		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	6	96	6		6		P	M
0	0	1045	9945	1051	94144	10055	95668	100	60
06	10	1063	9943	1069	93572	10057	94105	90	54
12	20	1080	9942	1086	92051	10059	92593	80	48
18	30	1097	9940	1104	90579	10061	91129	70	42
24	40	1115	9938	1122	89152	10063	89711	60	36
30	50	1132	9936	1139	87769	10065	88337	50	30
36	60	1149	9934	1157	86427	10067	87004	40	24
42	70	1167	9932	1175	85126	10069	85711	30	18
48	80	1184	9930	1192	83863	10071	84457	20	12
54	90	1201	9928	1210	82636	10073	83238	10	06
60	100	1219	9926	1228	81444	10075	82055	0	0
		173	83		83		83		

		Sines.		Tangents.		Secants.			
M	P	7	97	7		7		P	M
0	0	1219	9926	1228	81444	10075	82055	100	60
06	10	1236	9923	1246	80285	10077	80905	90	54
12	20	1253	9921	1263	79158	10079	79787	80	48
18	30	1271	9919	1281	78062	10082	78700	70	42
24	40	1288	9917	1299	76996	10084	77642	60	36
30	50	1305	9914	1316	75958	10086	76613	50	30
36	60	1323	9912	1334	74947	10089	75611	40	24
42	70	1340	9910	1352	73962	10091	74635	30	18
48	80	1357	9907	1370	73002	10093	73684	20	12
54	90	1374	9905	1388	72066	10096	72757	10	06
60	100	1392	9903	1405	71154	10098	71853	0	0
		172	82		82		82		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	8	98	8		8		P	M
0	0	1392	9903	1405	71154	10098	71853	100	60
06	10	1409	9900	1423	70264	10101	70978	90	54
12	20	1426	9898	1441	69395	10103	70112	80	48
18	30	1444	9895	1459	68547	10106	69273	70	42
24	40	1461	9893	1477	67719	10108	68454	60	36
30	50	1478	9890	1494	66912	10111	67655	50	30
36	60	1495	9888	1512	66122	10114	66874	40	24
42	70	1513	9885	1530	65350	10116	66111	30	18
48	80	1530	9882	1548	64596	10119	65366	20	12
54	90	1547	9880	1566	63859	10122	64637	10	06
60	100	1564	9877	1584	63138	10125	63925	0	0
		171	81		81		81		

		Sines.		Tangents.		Secants.			
M	P	9	99	9		9		P	M
0	0	1564	9877	1584	63138	10125	63925	100	60
06	10	1582	9874	1602	62432	10128	63228	90	54
12	20	1599	9871	1620	61742	10130	62546	80	48
18	30	1616	9869	1638	61066	10133	61879	70	42
24	40	1633	9866	1655	60405	10136	61227	60	36
30	50	1651	9863	1673	59758	10139	60589	50	30
36	60	1668	9860	1691	59124	10142	59963	40	24
42	70	1685	9857	1709	58502	10145	59351	30	18
48	80	1702	9854	1727	57894	10148	58751	20	12
54	90	1719	9851	1745	57297	10151	58164	10	06
60	100	1737	9848	1763	56713	10154	57588	0	0
		170	80		80		80		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	10	100	10		10		P	M
0	0	1737	9848	1763	56718	10154	57588	100	60
06	10	1754	9845	1781	56140	10157	57023	90	54
12	20	1771	9842	1799	55578	10161	56470	80	48
18	30	1788	9839	1817	55026	10164	55928	70	42
24	40	1805	9836	1835	54486	10167	55396	60	36
30	50	1822	9833	1853	53955	10170	44874	50	30
36	60	1840	9829	1871	53434	10174	54362	40	24
42	70	1857	9826	1890	52924	10177	53860	30	18
48	80	1874	9823	1908	52422	10180	53367	20	12
54	90	1891	9820	1926	51929	10184	52883	10	06
60	100	1908	9816	1944	51446	10187	52408	0	0
		169	79		79		79		

		Sines.		Tangents.		Secants.			
M	P	11	101	11		11		P	M
0	0	1908	9816	1944	51446	10187	52408	100	60
06	10	1925	9813	1952	50970	10191	51942	90	54
12	20	1942	9810	1980	50504	10194	51484	80	48
18	30	1959	9806	1998	50045	10198	51034	70	42
24	40	1977	9803	2016	49594	10201	50593	60	36
30	50	1994	9799	2034	49162	10204	50158	50	30
36	60	2011	9796	2053	48716	10208	49732	40	24
42	70	2028	9792	2071	48288	10212	49313	30	18
48	80	2045	9789	2089	47867	10216	48901	20	12
54	90	2062	9785	2107	47453	10220	48496	10	06
60	100	2079	9782	2126	47046	10223	48094	0	0
		168	78		78		78		



# A Table of

		Sines.		Tangents.		Secants.			
M	P	12	102	12		12		P	M
0	0	2079	9782	2125	47046	10223	48094	100	60
06	10	2026	9778	2141	45646	10227	47706	90	54
12	20	2113	9774	2162	46252	10231	47321	80	48
18	30	2130	9771	2180	45864	10235	46942	70	42
24	40	2147	9767	2199	45423	10239	46569	60	36
30	50	2164	9763	2217	45107	10243	46402	50	30
36	60	2181	9759	2235	44737	10247	45841	40	24
42	70	2199	9757	2254	44374	10251	45486	30	18
48	80	2216	9752	2272	44015	10255	45137	20	12
54	90	2233	9748	2290	43662	10259	44793	10	06
60	100	2250	9744	2309	43315	10263	44454	0	0
		167	77		77		77		

		Sines.		Tangents.		Secants.			
M	P	13	103	13		13		P	M
0	0	2250	9744	2309	43315	10263	44454	100	60
06	10	2267	9740	2327	42972	10267	44121	90	54
12	20	2284	9736	2346	42635	10271	43792	80	48
18	30	2301	9732	2364	42303	10276	43469	70	42
24	40	2318	9728	2382	41976	10280	43150	60	36
30	50	2335	9724	2401	41653	10284	42837	50	30
36	60	2351	9720	2419	41335	10289	42527	40	24
42	70	2368	9716	2438	41022	10293	42223	30	18
48	80	2385	9711	2456	40713	10297	41923	20	12
54	90	2402	9707	2475	40408	10302	41628	10	06
60	100	2419	9703	2493	40108	10306	41336	0	0
		166	76		76		76		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	14	104	14	14	14		P	M
0	0	2419	9703	2493	40108	10306	41336	100	60
06	10	2436	9699	2513	39812	10311	41048	90	54
12	20	2453	9695	2530	39520	10315	40765	80	48
18	30	2470	9690	2549	39232	10320	40486	70	42
24	40	2487	9686	2568	38947	10324	40211	60	36
30	50	2504	9682	2586	38667	10329	39939	50	30
36	60	2521	9677	2605	38391	10334	39672	40	24
42	70	2538	9673	2624	38118	10338	39408	30	18
48	80	2555	9668	2642	37848	10343	39144	20	12
54	90	2571	9664	2661	37583	10348	38890	10	06
60	100	2588	9659	2679	37321	10353	38637	0	0
		165	75		75		75		

		Sines.		Tangents.		Secants.			
M	P	15	105	15	15	15		P	M
0	0	2588	9659	2679	37321	10353	38637	100	60
06	10	2605	9655	2698	37062	10358	38387	90	54
12	20	2622	9650	2717	36806	10363	38140	80	48
18	30	2639	9646	2736	36554	10367	37897	70	42
24	40	2656	9641	2755	36305	10372	37657	60	36
30	50	2672	9636	2773	36059	10377	37420	50	30
36	60	2689	9632	2792	35816	10383	37186	40	24
42	70	2706	9627	2810	35576	10388	36955	30	18
48	80	2723	9622	2830	35339	10392	36726	20	12
54	90	2740	9617	2849	35105	10398	36502	10	06
60	100	2756	9613	2868	34874	10403	36280	0	0
		164	74		74		74		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	16	106	16	16	16		P	M
0	0	2756	9613	2868	34874	10403	36280	100	60
06	10	2773	9608	2886	34646	10408	36060	90	54
12	20	2790	9603	2905	34420	10413	35844	80	48
18	30	2807	9598	2924	34197	10419	35630	70	42
24	40	2823	9593	2943	33977	10424	35418	60	36
30	50	2840	9588	2962	33759	10429	35209	50	30
36	60	2857	9583	2981	33544	10434	35003	40	24
42	70	2874	9578	3000	33332	10440	34800	30	18
48	80	2890	9573	3019	33122	10446	34598	20	12
54	90	2907	9568	3038	32914	10451	34400	10	06
60	100	2924	9563	3057	32709	10457	34203	0	0
		163	73	73		73			

		Sines.		Tangents.		Secants.			
M	P	17	103	13		17		P	M
0	0	2924	9563	3057	32709	10457	34203	100	60
06	10	2940	9558	3076	32506	10463	34009	90	54
12	20	2957	9553	3096	32305	10468	33817	80	48
18	30	2974	9548	3115	32106	10474	33628	70	42
24	40	2990	9542	3134	31910	10480	33440	60	36
30	50	3007	9537	3152	31716	10485	33255	50	30
36	60	3024	9532	3172	31524	10491	33072	40	24
42	70	3040	9527	3191	31334	10497	32891	30	18
48	80	3057	9521	3211	31146	10503	32712	20	12
54	90	3074	9515	3230	30981	10509	32536	10	06
60	100	3090	9511	3249	30777	10515	32361	0	0
		162	72	72		72			

# A Table of

		Sines.		Tangents.		Secants.			
M	P	18	108	18		10		P	M
0	0	3090	9511	3249	30777	10515	32301	100	60
06	10	3107	9505	3269	35095	10521	32188	90	54
12	20	3123	9500	3288	30415	10527	32017	80	48
18	30	3140	9494	3307	30237	10533	31848	70	42
24	40	3157	9489	3327	30061	10539	31681	60	36
30	50	3173	9483	3346	29887	10545	31515	50	30
36	60	3190	9478	3365	29714	10552	31352	40	24
42	70	3206	9472	3385	29544	10557	31190	30	18
48	80	3223	9467	3404	29375	10564	31030	20	12
54	90	3239	9461	3424	29208	10570	30872	10	06
60	100	3256	9455	3443	29042	10576	30716	0	0
		161	71		71		71		

		Sines.		Tangents.		Secants.			
M	P	19	109	19		19		P	M
0	0	3256	9455	3443	29042	10576	30716	100	60
06	10	3272	9450	3463	28878	10583	30561	90	54
12	20	3289	9444	3482	28716	10589	30408	80	48
18	30	3305	9438	3502	28556	10596	30256	70	42
24	40	3322	9432	3522	28397	10602	30106	60	36
30	50	3338	9426	3541	28239	10609	29957	50	30
36	60	3355	9421	3561	28083	10615	29811	40	24
42	70	3371	9415	3581	27929	10622	29665	30	18
48	80	3387	9409	3600	27776	10628	29521	20	12
54	90	3404	9403	3620	27625	10635	29379	10	06
60	100	3420	9397	3640	27475	10642	29238	0	0
		160	70		70		70		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	20	110	20		20		P	M
0	0	3420	9397	3640	27475	10642	29238	100	60
06	10	3437	9391	3660	27326	10647	29099	90	54
12	20	3453	9385	3679	27179	10655	28961	80	48
18	30	3469	9379	3699	27034	10662	28824	70	42
24	40	3486	9373	3719	26889	10669	28689	60	36
30	50	3502	9367	3739	26746	10676	28555	50	30
36	60	3518	9361	3759	26605	10683	28422	40	24
42	70	3535	9354	3779	26464	10690	28291	30	18
48	80	3551	9348	3799	26325	10697	28161	20	12
54	90	3567	9342	3819	26187	10704	28032	10	06
60	100	3584	9336	3839	26051	10711	27904	0	0
		159	69		69		69		

		Sines.		Tangents.		Secants.			
M	P	21	111	21		21		P	M
0	0	3584	9336	3839	26051	10711	27904	100	60
06	10	3600	9329	3859	25916	10719	27778	90	54
12	20	3616	9323	3879	25782	10726	27653	80	48
18	30	3633	9317	3899	25649	10738	27529	70	42
24	40	3649	9311	3919	25517	10740	27406	60	36
30	50	3665	9304	3939	25386	10748	27285	50	30
36	60	3681	9298	3959	25257	10755	27165	40	24
42	70	3697	9291	3980	25129	10763	27045	30	18
48	80	3714	9285	4000	25002	10770	26927	20	12
54	90	3730	9278	4020	24876	10778	26810	10	06
60	100	3746	9272	4040	24751	10785	26695	0	0
		158	68		68		68		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	22	112	22		22		P	M
0	0	3746	9272	4049	24751	10585	26695	100	60
06	10	3762	9265	4061	24627	10793	26580	90	54
12	20	3778	9259	4081	24504	10801	26466	80	48
18	30	3795	9252	4101	24382	10808	26353	70	42
24	40	3811	9245	4122	24262	10816	26242	60	36
30	50	3827	9239	4142	24142	10824	26131	50	30
36	60	3843	9232	4163	24064	10832	26042	40	24
42	70	3859	9225	4183	23906	10840	25913	30	18
48	80	3875	9219	4204	23789	10848	25805	20	12
54	90	3891	9212	4224	23673	10856	25699	10	06
60	100	3907	9205	4245	23558	10864	25593	0	0
		157	67		67		67		

		Sines.		Tangents.		Secants.			
M	P	23	113	23		23		P	M
0	0	3907	9205	4245	23558	10864	25593	100	60
06	10	3923	9198	4265	23445	10872	25488	90	54
12	20	3939	9191	4286	23332	10880	25385	80	48
18	30	3955	9185	4307	23220	10888	25282	70	42
24	40	3971	9177	4327	23109	10896	25180	60	36
30	50	3987	9171	4348	22998	10904	25078	50	30
36	60	4004	9164	4369	22889	10913	24978	40	24
42	70	4020	9157	4380	22781	10921	24879	30	18
48	80	4036	9150	4411	22673	10929	24780	20	12
54	90	4051	9143	4431	22566	10938	24683	10	06
60	100	4067	9135	4452	22460	10946	24586	0	0
		156	66		66		66		



# A Table of

		Sines.	Tangents.	Secants.		
M	P	24	114	24	24	P M
0	0	4067	9136	4452	22460	100 60
06	10	4083	9128	4473	22355	90 54
12	20	4099	9121	4494	22251	80 48
18	30	4115	9114	4515	22148	70 42
24	40	4131	9107	4536	22045	60 36
30	50	4147	9100	4557	21943	50 30
36	60	4163	9092	4578	21842	40 24
42	70	4179	9085	4599	21742	30 18
48	80	4194	9078	4621	21642	20 12
54	90	4210	9070	4642	21543	10 06
60	100	4226	9063	4663	21445	0 0
		155	65		65	

		Sines.	Tangents.	Secants.		
M	P	25	115	25	25	P M
0	0	4226	9063	4663	21445	100 60
06	10	4242	9056	4684	21348	90 54
12	20	4258	9048	4706	21251	80 48
18	30	4274	9041	4727	21155	70 42
24	40	4289	9033	4748	21060	60 36
30	50	4305	9026	4770	20965	50 30
36	60	4321	9018	4791	20872	40 24
42	70	4337	9011	4813	20779	30 18
48	80	4352	9003	4834	20686	20 12
54	90	4368	8996	4856	20594	10 06
60	100	4384	8988	4877	20503	0 0
		154	54		82	

# A Table of

		Sines.		Tangents.		Secants.			
M	P	26	116	26		26		P	M
0	0	4834	8988	4877	20503	11126	22812	100	60
06	10	4399	8980	4899	20412	11136	22730	90	54
12	20	4415	8973	4921	20323	11145	22650	80	48
18	30	4431	8965	4942	20234	11155	22570	70	42
24	40	4438	8957	4954	20145	11164	22530	60	36
30	50	4462	8949	4986	20057	11174	22412	50	30
36	60	4478	8942	5008	19970	11184	22333	40	24
42	70	4493	8934	5030	19883	11194	22256	30	18
48	80	4509	8926	5051	19797	11204	22179	20	12
54	90	4524	8918	5073	19711	11213	22103	10	06
60	100	4540	8915	5090	19626	11223	22027	0	0
		153	63		63		63		

		Sines.		Tangents.		Secants.			
M	P	27	117	27		27		P	M
0	0	4540	8915	5095	19626	11223	22026	100	60
06	10	4555	8902	5117	19542	11233	21952	90	54
12	20	4571	8894	5139	19458	11243	21877	80	48
18	30	4587	8886	5161	19375	11253	21803	70	42
24	40	4602	8878	5184	19292	11264	21730	60	36
30	50	4618	8870	5206	19210	11274	21657	50	30
36	60	4633	8862	5228	19128	11284	21585	40	24
42	70	4648	8854	5250	19047	11294	21513	30	18
48	80	4664	8846	5272	18967	11305	21442	20	12
54	90	4679	8838	5295	18887	11315	21371	10	06
60	100	4695	8830	5317	18807	11326	21301	0	0
		152	62		62		62		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	28	118	28		28		P	M
0	0	4695	8830	5317	10807	11326	21301	100	60
06	10	4710	8821	5340	18728	11336	21231	90	54
12	20	4725	8813	5362	18650	11347	21162	80	48
18	30	4741	8805	5384	18572	11357	21093	70	42
24	40	4756	8796	5407	18495	11368	21025	60	36
30	50	4772	8788	5430	18418	11379	21957	50	30
36	60	4787	8780	5452	18341	11390	20290	40	24
42	70	4802	8771	5475	18265	11401	20824	30	18
48	80	4817	8763	5497	18190	11411	20757	20	12
54	90	4833	8755	5520	18115	11422	20692	10	06
60	100	4848	8746	5543	18040	11434	20627	0	0
		151	61		61		61		

		Sines.		Tangents.		Secants.			
M	P	29	119	29		29		P	M
0	0	4848	8746	5543	18046	11434	20627	100	60
06	10	4863	8738	5566	17966	11445	20562	90	54
12	20	4879	8729	5589	17893	11456	20498	80	48
18	30	4894	8721	5612	17820	11467	20434	70	42
24	40	4909	8712	5635	17747	11478	20371	60	36
30	50	4924	8704	5656	17665	11490	20308	50	30
36	60	4939	8695	5681	17603	11401	20245	40	24
42	70	4955	8686	5704	17532	11512	20183	30	18
48	80	4970	8678	5727	17461	11524	20122	20	12
54	90	4985	8669	5750	17390	11535	20061	10	06
60	100	5000	8660	5774	17320	11547	20000	0	0
		159	60		60		60		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	30	120	30		30		P	M
0	0	5000	8650	5774	17321	11547	20000	100	60
06	10	5015	8652	5797	17251	11559	19910	90	54
12	20	5030	8643	5820	17182	11570	19880	80	48
18	30	5045	8634	5844	17113	11582	19821	70	42
24	40	5060	8625	5867	17045	11594	19762	60	36
30	50	5075	8616	5890	16977	11606	19703	50	30
36	60	5090	8607	5914	16909	11618	19645	40	24
42	70	5105	8599	5938	16842	11630	19587	30	18
48	80	5120	8590	5961	16775	11642	19530	20	12
54	90	5135	8581	5985	16709	11654	19473	10	06
60	100	5150	8572	6009	16643	11666	19416	0	0
		149	59		59		59		

		Sines.		Tangents.		Secants.			
M	P	31	121	31		31		P	M
0	0	5150	8572	6009	16643	11666	19416	100	60
06	10	5165	8563	6032	16577	11679	19360	90	54
12	20	5180	8554	6056	16512	11691	19304	80	48
18	30	5195	8545	6080	16447	11703	19249	70	42
24	40	5210	8536	6104	16383	11716	19194	60	36
30	50	5225	8526	6128	16318	11728	19139	50	30
36	60	5240	8517	6152	16255	11741	19085	40	24
42	70	5255	8508	6176	16191	11754	19030	30	18
48	80	5270	8499	6200	16128	11766	18977	20	12
54	90	5284	8490	6224	16066	11779	18924	10	06
60	100	5299	8480	6249	16003	11792	18871	0	0
		148	58		58		58		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	32	122	32		32		P	M
0	0	5299	8480	6249	16003	11792	18871	100	60
06	10	5314	8471	6273	15941	11805	18818	90	54
12	20	5329	8462	6297	15880	11818	18766	80	48
18	30	5344	8452	6322	15819	11831	18714	70	42
24	40	5358	8443	6346	15758	11844	18663	60	36
30	50	5373	8434	6371	15697	11857	18612	50	30
36	60	5388	8425	6395	15637	11870	18561	40	24
42	70	5402	8415	6420	15577	11883	18510	30	18
48	80	5417	8406	6445	15517	11897	18460	20	12
54	90	5432	8396	6469	15458	11910	18410	10	06
60	100	5446	8387	6494	15399	11924	18361	0	0
		147	57		57		57		

		Sines.		Tangents.		Secants.			
M	P	33	123	33		33		P	M
0	0	5446	8387	6494	15399	11924	18361	100	60
06	10	5461	8377	6519	15340	11937	18312	90	54
12	20	5476	8368	6544	15282	11951	18263	80	48
18	30	5490	8358	6569	15224	11965	18214	70	42
24	40	5505	8349	6594	15166	11978	18166	60	36
30	50	5519	8339	6619	15108	11992	18118	50	30
36	60	5534	8329	6644	15051	12006	18070	40	24
42	70	5548	8319	6660	14994	12020	17023	30	18
48	80	5563	8310	6694	14938	12034	17976	20	12
54	90	5578	8300	6720	14882	12048	17929	10	06
60	100	5592	8290	6745	14826	12062	17883	0	0
		146	56		56		56		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	34	124	34		34		P	M
0	0	5520	8290	6745	14826	12062	17883	100	60
06	10	5606	8281	6770	14770	12076	17837	90	54
12	20	5621	8271	6796	14715	12091	17391	80	48
18	30	5635	8261	6822	14650	12105	17745	70	42
24	40	5656	8251	6847	14605	12119	17700	60	36
30	50	5664	8241	6873	14550	12134	17655	50	30
36	60	5678	8231	6898	14496	12149	17610	40	24
42	70	5693	8221	6924	14442	12163	17566	30	18
48	80	5707	8211	6950	14388	12178	17522	20	12
54	90	5721	8202	6976	14335	12193	17478	10	06
60	100	5736	8191	7002	14282	12208	17434	0	0
		145	55		55		55		

		Sines.		Tangents.		Secants.			
M	P	35	125	35		35		P	M
0	0	5736	8191	7002	14282	12208	17434	100	60
06	10	5750	8181	7028	14229	12223	17391	90	54
12	20	5764	8171	7054	14176	12238	17348	80	48
18	30	5789	8161	7080	14124	12253	17305	70	42
24	40	5793	8151	7107	14071	12268	17263	60	36
30	50	5807	8141	7133	14019	12283	17220	50	30
36	60	5821	8131	7159	13968	12299	17178	40	24
42	70	5835	8121	7186	13916	12314	17137	30	18
48	80	5841	8111	7212	13865	12329	17095	20	12
54	90	5864	8100	7239	13814	12345	17054	10	06
60	100	5878	8090	7265	13764	12361	17013	0	0
		144	54		54		54		



# A Table of

		Sines.		Tangents.		Secants.			
M	P	36	126	36		36		P	M
0	0	5878	8090	7265	13764	12361	17013	100	60
06	10	5892	8080	7292	13713	12376	16972	90	54
12	20	5906	8070	7319	13663	12392	16932	80	48
18	30	5920	8059	7346	13613	12408	16892	70	42
24	40	5934	8049	7373	13564	12424	16852	60	36
30	50	5948	8039	7400	13514	12440	16812	50	30
36	60	5962	8028	7427	13465	12456	16772	40	24
42	70	5976	8018	7454	13416	12472	16733	30	18
48	80	5990	7997	7481	13367	12489	16694	20	12
54	90	6004	7997	7508	13319	12505	16655	10	06
60	100	6018	7986	7535	13270	12521	16616	0	0
		143	53		53		53		

		Sines.		Tangents.		Secants.			
M	P	37	127	37		37		P	M
0	0	6018	7986	7535	13270	12521	16616	100	60
06	10	6032	7976	7563	13222	12538	16578	90	54
12	20	6046	7965	7590	13175	12555	16540	80	48
18	30	6060	7955	7618	13127	12571	16502	70	42
24	40	6074	7944	7646	13080	12588	16464	60	36
30	50	6088	7934	7673	13032	12605	16427	50	30
36	60	6101	7923	7701	12985	12622	16390	40	24
42	70	6115	7912	7729	12939	12639	16352	30	18
48	80	6129	7901	7757	12892	12656	16316	20	12
54	90	6143	7891	7785	12846	12673	16279	10	06
60	100	6157	7880	7813	12799	12690	16243	0	0
		142	52		52		52		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	38	128	37		37		P	M
0	0	6157	7880	7813	12799	12690	16243	100	60
06	10	6170	7869	7841	12754	12707	16206	90	54
12	20	6184	7859	7869	12708	12725	16170	80	48
18	30	6198	7848	7898	12662	12742	16133	70	42
24	40	6212	7837	7926	12617	12760	16099	60	36
30	50	6225	7826	7954	12572	12778	16064	50	30
36	60	6239	7815	7983	12527	12796	16029	40	24
42	70	6252	7804	8012	12482	12813	15994	30	18
48	80	6266	7793	8040	12437	12831	15959	20	12
54	90	6280	7782	8069	12393	12850	15924	10	06
60	100	6293	7772	8098	12349	12868	15890	0	0
		141	51	51		51			

		Sines.		Tangents.		Secants.			
M	P	39	129	39		39		P	M
0	0	6293	7772	8098	12349	12868	15890	100	60
06	10	6307	7761	8127	12305	12886	15856	90	54
12	20	6320	7749	8156	12161	12904	15822	80	48
18	30	6334	7738	8185	12218	12923	15788	70	42
24	40	6347	7727	8214	12174	12941	15755	60	36
30	50	6361	7716	8243	12131	12960	15721	50	30
36	60	6374	7705	8273	12088	12978	15688	40	24
42	70	6387	7694	2292	12045	12997	15655	30	18
48	80	6401	7683	8332	12002	13016	15622	20	12
54	90	6415	7672	8361	11960	13035	15590	10	06
60	100	6428	7660	8391	11917	13054	15557	0	0
		140	50	50		50			

# A Table of

		Sines.		Tangents.		Secants.			
M	P	40	130	40		40		P	M
0	0	6428	7660	8391	11917	13054	15557	100	60
06	10	6441	7649	8421	11875	13073	15525	90	54
12	20	6455	7638	8451	11833	13092	15493	80	48
18	30	6468	7627	8481	11792	13112	15461	70	42
24	40	6481	7615	8511	11750	13132	15429	60	36
30	50	6494	7604	8541	11708	13151	15398	50	30
36	60	6508	7593	8571	11667	13170	15360	40	24
42	70	6521	7581	8601	11626	13190	15335	30	18
48	80	6534	7570	8632	11585	13210	15304	20	12
54	90	6547	7559	8662	11544	13230	15273	10	06
60	100	6561	7547	8693	11504	13250	15243	0	0
		139	49		49		49		

		Sines.		Tangents.		Secants.			
M	P	41	131	41		41		P	M
0	0	6561	7547	8693	11504	13250	15243	100	60
06	10	6574	7536	8724	11463	13270	15212	90	54
12	20	6587	7524	8754	11423	13290	15182	80	48
18	30	6600	7513	8785	11383	13311	15152	70	42
24	40	6613	7501	8816	11343	13331	15122	60	36
30	50	6626	7490	8847	11303	13352	15092	50	30
36	60	6639	7478	8878	11263	13373	15062	40	24
42	70	6652	7466	8910	11224	13393	15032	30	18
48	80	6665	7455	8941	11184	13414	15003	20	12
54	90	6678	7443	8972	11145	13435	14974	10	06
60	100	6691	7431	9004	11106	13456	14945	0	0
		138	43		48		48		

# A Table of

		Sines.		Tangents.		Secants.			
M	P	42	132	42	42	42		P	M
0	0	6691	7431	9004	11106	13456	14945	100	60
06	10	6704	7419	9036	11067	13477	14916	90	54
12	20	6717	7408	9067	11029	13499	14887	80	48
18	30	6730	7396	9099	10990	13520	14859	70	42
24	40	6743	7385	9131	10951	13542	14830	60	36
30	50	6756	7373	9163	10913	13563	14802	50	30
36	60	6769	7361	9195	10875	13585	14774	40	24
42	70	6782	7349	9228	10837	13607	14746	30	18
48	80	6794	7337	9260	10799	13629	14718	20	12
54	90	6807	7325	9293	10761	13651	14690	10	06
60	100	6820	7313	9325	10724	13673	14663	0	0
		137	47	47	47	47			

		Sines.		Tangents.		Secants.			
M	P	43	133	43	43	43		P	M
0	0	6820	7313	9325	10724	13673	14663	100	60
06	10	6833	7302	9358	10686	13696	14635	90	54
12	20	6846	7290	9391	10649	13718	14608	80	48
18	30	6858	7278	9423	10612	13741	14581	70	42
24	40	6871	7256	9457	10575	13763	14554	60	36
30	50	6883	7254	9490	10538	13786	14527	50	30
36	60	6896	7242	9523	10501	13809	14501	40	24
42	70	6909	7230	9556	10464	13832	14474	30	18
48	80	6921	7218	9590	10428	13855	14448	20	12
54	90	6934	7205	9623	10391	13878	14422	10	06
60	100	6947	7193	9657	10355	13902	14396	0	0
		136	46	46	46	46			

# A Table of

		Sines.		Tangents.		Secants.			
M	P	44	134	44		44		P	M
0	0	6947	7193	9657	10355	13902	14396	100	60
06	10	6959	7181	9691	10319	13925	14370	90	54
12	20	6972	7169	9725	10283	13945	14344	80	48
18	30	6984	7157	9759	10247	13973	14318	70	42
24	40	6997	7145	9793	10212	13996	14293	60	36
30	50	7009	7133	9827	10176	14020	14267	50	30
36	60	7022	7120	9861	10141	14044	14242	40	24
42	70	7034	7108	9896	10105	14069	14217	30	18
48	80	7046	7096	9930	10070	14093	14192	20	12
54	90	7079	7083	9965	10035	14117	14167	10	06
60	100	7071	7071	10000	10000	14142	14142	0	0
		135	45		45		47		

## A Note of good Use.

**A**LL these kind of Tables are never calculated farther than to the right Angle, or 90 deg. But yet many times your Angle which you should use falls out to be an Obtuse Angle, above 90 deg. in which case the ordinary Rule is, to take the complement of your Angle to 180 deg. or else the complement of the excess of your Angle above 90 deg. But to ease this trouble, and to prevent mistakes herein, I have in the Table of Sines set down the Degrees for these Angles above 90 to 180 deg. the Minutes or Centesimes are to be found as for the other Degrees, either upward or downward, according as the deg. stands at the top or bottom of the Columne.

Thus the Sine of 134 deg. 18 Min. or 30 C. is 7157.  
And the Sine of 135 deg. 42 Min. or 70 C. is 6984.

# A Table of Meridional Parts.

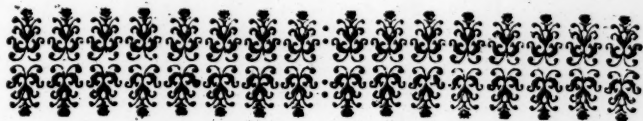
Degrees of Lat.		Minutes or Sexagenary parts of a Degree.										The Difference.										
		0	6	12	18	24	30	36	42	48	54											
		Decimals, or Hundred parts of a Degree.																				
		0	10	20	30	40	50	60	70	80	90											
		D. pts.	D. pts.	D. pts.	D. pts.	D. pts.	D. pts.	D. pts.	D. pts.	D. pts.	D. pts.											
0	00	000	00	100	00	200	00	300	00	400	00	500	00	600	00	700	00	800	00	900	00	1000
1	01	006	01	106	01	206	01	306	01	406	01	506	01	606	01	706	01	806	01	906	01	1006
2	02	002	02	102	02	202	02	302	02	402	02	502	02	602	02	702	02	802	02	902	02	1002
3	03	001	03	101	03	201	03	301	03	402	03	502	03	602	03	702	03	803	03	903	03	1003
4	04	003	04	103	04	204	04	304	04	404	04	504	04	605	04	705	04	805	04	905	04	1005
5	05	006	05	106	05	207	05	307	05	408	05	508	05	609	05	709	05	810	05	910	05	1010
6	06	011	06	111	06	212	06	312	06	413	06	514	06	614	06	715	06	816	06	916	06	1016
7	07	017	07	117	07	219	07	319	07	420	07	521	07	622	07	723	07	824	07	925	07	1025
8	08	026	08	127	08	228	08	329	08	430	08	531	08	632	08	733	08	834	08	936	08	1036
9	09	037	09	138	09	239	09	341	09	442	09	543	09	645	09	746	09	848	09	949	09	1049
10	10	048	10	149	10	251	10	355	10	457	10	559	10	661	10	762	10	864	10	965	10	1065
11	11	068	11	172	11	272	11	374	11	476	11	578	11	680	11	782	11	884	11	986	11	1086
12	12	088	12	190	12	293	12	395	12	497	12	600	12	702	12	805	12	907	12	1010	12	1102
13	13	112	13	215	13	318	13	421	13	523	13	626	13	729	13	832	13	935	14	038	13	1133
14	14	141	14	244	14	347	14	450	14	553	14	656	14	760	14	863	14	967	15	070	14	1163
15	15	174	15	277	15	381	15	485	15	588	15	692	15	795	15	900	16	004	15	107	15	1194
16	16	211	16	316	16	420	16	524	16	628	16	732	16	836	16	941	17	045	17	150	16	1244
17	17	255	17	359	17	464	17	568	17	673	17	778	17	883	17	988	18	093	18	198	17	1283
18	18	303	18	408	18	513	18	619	18	724	18	830	18	935	19	041	19	146	19	251	18	1333
19	19	356	19	461	19	567	19	673	19	778	19	883	19	989	20	100	20	206	20	312	19	1386
20	20	419	20	525	20	632	20	739	20	845	20	952	21	059	21	165	21	272	21	379	20	1445
21	21	486	21	593	21	701	21	808	21	915	22	023	22	130	22	238	22	345	22	453	21	1503
22	22	561	22	669	22	777	22	885	22	993	23	101	23	210	23	318	23	427	23	535	22	1568
23	23	643	23	752	23	861	23	970	24	079	24	188	24	297	24	406	24	515	24	624	23	1624
24	24	734	24	844	24	953	25	063	25	173	25	282	25	392	25	502	25	613	25	723	24	1683
25	25	833	25	943	26	054	26	164	26	275	26	386	26	497	26	608	26	719	26	830	25	1743
26	26	941	27	052	27	164	27	275	27	387	27	499	27	610	27	722	27	833	27	945	26	1803
27	28	048	28	171	28	283	28	396	28	508	28	621	28	734	28	847	28	959	29	072	27	1863
28	29	186	29	299	29	423	29	526	29	640	29	753	29	867	29	981	30	095	30	209	28	1923
29	30	324	30	438	30	553	30	667	30	782	30	897	31	112	31	127	31	242	31	357	29	1983
30	31	473	31	588	31	704	31	820	31	936	32	052	32	168	32	284	32	400	32	517	30	2033
31	32	633	32	750	32	867	32	984	33	101	33	218	33	336	33	453	33	571	33	688	31	2093
32	33	806	33	924	34	042	34	161	34	279	34	397	34	516	34	635	34	754	34	873	32	2153
33	34	992	35	111	35	231	35	350	35	470	35	590	35	710	35	830	35	950	36	071	33	2213
34	36	191	36	312	36	433	36	554	36	675	36	796	36	917	37	039	37	161	37	283	34	2273
35	37	405	37	527	37	649	37	771	37	894	38	017	38	140	38	263	38	386	38	509	35	2333
36	38	633	38	757	38	880	39	004	39	129	39	253	39	377	39	502	39	627	39	752	36	2393
37	39	877	40	002	40	128	40	253	40	379	40	505	40	631	40	757	40	884	41	011	37	2453
38	41	137	41	264	41	392	41	519	41	646	41	774	41	902	42	030	42	158	42	287	38	2513
39	42	415	42	544	42	673	42	802	42	931	43	061	43	191	43	320	43	451	43	581	39	2573
40	43	711	43	842	43	973	44	104	44	235	44	366	44	498	44	630	44	762	44	894	40	2633
41	45	026	45	159	45	292	45	425	45	558	45	691	45	825	45	959	46	093	46	227	41	2693
42	46	362	46	496	46	631	46	766	46	902	47	037	47	173	47	309	47	445	47	581	42	2753
43	47	718	47	855	47	992	48	129	48	267	48	404	48	542	48	681	48	819	48	958	43	2813
44	49	097	49	236	49	375	49	515	49	655	49	795	49	935	50	075	50	217	50	359	44	2873



# A Table of Meridional Parts.

Minutes or Sexagenary parts of a Degree.											
Decimals, or Hundred parts of a Degree.											
D. pts.	D. pts.										
	0	10	20	30	40	50	60	70	80	90	
0	10	20	30	40	50	60	70	80	90		
10	20	30	40	50	60	70	80	90			
20	30	40	50	60	70	80	90				
30	40	50	60	70	80	90					
40	50	60	70	80	90						
50	60	70	80	90							
60	70	80	90								
70	80	90									
80	90										
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980											
990											
1000											

The Difference.



## *Of the Table of Meridional parts.*

**A**S I have added the Tables of *Sines*, *Tangents* and *Secants* in natural numbers, to serve for the confirmation and proof of my way of working by my new *Canon*; so I have likewise added this Table of *Meridional parts*, for the farther illustration thereof; whereby you may not onely see the truth of my way of working by *Secants*, for the finding of the degrees of Longitude, but also the ready performance thereof.

The nature and use of this Table is so well known, that I shall not need to write a word about it. But this I would have you take notice of; That if you work by this Table, there is first as much trouble to find out the *Meridional parts*; and then having found them, you must afterwards frame them into a Triangle, and resolve it by Calculation; according to this Proportion,

*As the Radius,  
To the difference of Latitude in Meridional parts,  
So is the Tangent of the Rumb,  
To the difference of Longitude.*

# A Table of PROPORTION, for the Differences in all the Tables.

1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10	51	102	153	204	255	306	357	408	459	510
2	4	6	8	10	12	14	16	18	20	52	104	156	208	260	312	364	416	468	520
3	6	9	12	15	18	21	24	27	30	53	106	159	212	265	318	371	424	477	530
4	8	12	16	20	24	28	32	36	40	54	108	162	216	270	324	378	432	486	540
5	10	15	20	25	30	35	40	45	50	55	110	165	220	275	330	385	440	495	550
6	12	18	24	30	36	42	48	54	60	56	112	168	224	280	336	392	448	504	560
7	14	21	28	35	42	49	56	63	70	57	114	171	228	285	342	399	456	513	570
8	16	24	32	40	48	56	64	72	80	58	116	174	232	290	348	406	464	522	580
9	18	27	36	45	54	63	72	81	90	59	118	177	236	295	354	413	472	531	590
10	20	30	40	50	60	70	80	90	100	60	120	180	240	300	360	420	480	540	600
11	22	33	44	55	66	77	88	99	110	61	122	183	244	305	366	427	488	549	610
12	24	36	48	60	72	84	96	108	120	62	124	186	248	310	372	434	496	558	620
13	26	39	52	65	78	91	104	117	130	63	126	189	252	315	378	441	504	567	630
14	28	42	56	70	84	98	112	125	140	64	128	192	256	320	384	448	512	576	640
15	30	45	60	75	90	105	120	135	150	65	130	195	260	325	390	455	520	585	650
16	32	48	64	80	96	112	128	144	160	66	132	198	264	330	396	462	528	594	660
17	34	51	68	85	102	119	136	153	170	67	134	201	268	335	402	469	536	603	670
18	36	54	72	90	108	126	144	162	180	68	136	204	272	340	408	476	544	612	680
19	38	57	76	95	114	133	152	171	190	69	138	207	276	345	414	483	552	621	690
20	40	60	80	100	120	140	160	180	200	70	140	210	280	350	420	490	560	630	700
21	42	63	84	105	126	147	168	189	210	71	142	213	284	355	426	497	568	639	710
22	44	66	88	110	132	154	176	198	220	72	144	216	288	360	432	504	576	648	720
23	46	69	92	115	138	161	184	207	230	73	146	219	292	365	438	511	584	657	730
24	48	72	96	120	144	168	192	216	240	74	148	222	296	370	444	518	592	666	740
25	50	75	100	125	150	175	200	225	250	75	150	225	300	375	450	525	600	675	750
26	52	78	104	130	156	182	208	234	260	76	152	228	304	380	456	532	608	684	760
27	54	81	108	135	162	189	216	243	270	77	154	231	308	385	462	539	616	693	770
28	56	84	112	140	168	196	224	252	280	78	156	234	312	390	468	546	624	702	785
29	58	87	116	145	174	203	232	261	290	79	158	237	316	395	474	553	632	711	790
30	60	90	120	150	180	210	240	270	300	80	160	240	320	400	480	560	640	720	800
31	62	93	124	155	186	217	248	279	310	81	162	243	324	405	486	567	648	729	810
32	64	96	128	160	192	224	256	288	320	82	164	246	328	410	492	574	656	738	820
33	66	99	132	165	198	231	264	297	330	83	166	249	332	415	498	581	664	747	830
34	68	102	136	170	204	238	276	306	340	84	168	252	336	420	504	588	672	756	840
35	70	105	140	175	210	245	280	315	350	85	170	255	340	425	510	595	680	765	850
36	72	108	144	180	216	252	288	324	360	86	172	258	344	430	516	602	688	774	860
37	74	111	148	185	222	259	296	333	370	87	174	261	348	435	522	609	696	783	870
38	76	114	152	190	228	266	304	342	380	88	176	264	352	440	528	616	704	792	880
39	78	117	156	195	234	273	312	351	390	89	178	267	356	445	534	623	712	801	890
40	80	120	160	200	240	280	320	360	400	90	180	270	360	450	540	630	720	810	900
41	82	123	164	205	246	287	328	369	410	91	182	273	364	455	546	637	725	819	910
42	84	126	168	210	252	294	336	378	420	92	184	276	368	460	552	644	736	828	920
43	86	129	172	215	258	301	344	387	430	93	186	279	372	465	558	651	744	837	930
44	88	132	176	220	264	308	352	396	440	94	188	282	376	470	564	658	752	846	940
45	90	135	180	225	270	315	360	405	450	95	190	284	380	475	570	665	760	855	950
46	92	138	184	230	276	322	368	414	460	96	192	288	384	480	576	672	768	864	960
47	94	141	188	235	282	329	376	423	470	97	194	291	388	485	582	679	776	873	970
48	96	144	192	240	288	336	384	432	480	98	196	294	392	490	588	686	784	882	980
49	98	147	196	245	294	343	392	441	490	99	198	297	396	495	594	693	792	891	990
50	100	150	200	250	300	350	400	450	500	100	200	300	400	500	600	700	800	900	1000
1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10



## The Use of this Table of Proportion.

**T**He use I shall make of this Table here, is to find the part proportional for any Decimal, or centesim part of a degree, by the difference which is set down in these Tables between each degree. And here the question or the case is twofold: either by the difference to find the part proportional for any part of that degree, or else by the difference and the part proportional allotted, to find the part of the degree answering thereunto.

For the first, knowing the difference, and the part of the degree, to find the part proportional thereof. This may easily be done by Multiplication, but more readily by this Table; for here find but the whole difference in the first column, and the other columns shew the part Proportional for every tenth part of the degree, if the said difference be not more than 100 parts, only you must separate the last figure from the other by a (.) for a Fraction.

The first Case to find the proportional part for any part of a Degree.

Thus the difference between any degree being 65 parts, the part proportional for each Decimal or tenth part of that degree will be as in the Table, in the line against 65.

*Viz.*

1	2	3	4	5	6	7	8	9	10
6.5	13.0	19.5	26.0	32.5	39.0	45.5	52.0	58.5	65.0

If you would have the part proportional for each Centesim of a degree; first, set down for the Decimal part, as before, and afterwards for the Centesim part; and so adding them together, and cutting off the two last figures, as a Fraction, you shall have the part proportional thereof.

Thus

Thus the difference being 65 as, before, the proportional parts will be thus.

11	22	33	44	55	66	77	88	99
65	130	195	260	375	390	455	520	585
<u>65</u>	<u>130</u>	<u>195</u>	<u>260</u>	<u>375</u>	<u>390</u>	<u>455</u>	<u>520</u>	<u>585</u>
7.15	14.30	21.45	28.60	41.25	42.90	50.05	57.20	64.35

If the difference of your whole degree be above 100 parts, seek the nearest number in the last column, and take that line for your decimal parts, as before, so the error will not be much. Thus your difference being 655, you may take either the line 650, or 660, without any great danger of error, if you work only in Decimal parts: but if you will be more exact, take first the part proportional for the two first figures thereof, and afterwards for the other figure, you may find the centesim thereof the long wayes of the Table, which fitly placed under the other, and added together, shews the true part proportional.

Thus first for 650, and then for 005, the proportional part is thus:

11	22	33	44	55	66	77	88	99
65	130	195	260	325	390	455	520	585
<u>65</u>	<u>130</u>	<u>195</u>	<u>260</u>	<u>325</u>	<u>390</u>	<u>455</u>	<u>520</u>	<u>585</u>
55	110	165	220	275	330	385	440	495
<u>55</u>	<u>110</u>	<u>165</u>	<u>220</u>	<u>275</u>	<u>330</u>	<u>385</u>	<u>440</u>	<u>495</u>
72.05	144.10	216.15	288.20	360.25	432.30	504.35	576.40	648.45

If you think this too much trouble, you may content your self, as I said before, with the Decimal part, which may more easily be had, and is exact enough in most cases: But this is as soon and sooner performed, than the ordinary way by the Rule of proportion, viz.

As

As the whole degree or 100 parts,	100	655
To the whole difference	655	99
So any centesim part of a degree	99	5895
To the part propotional thereof	648.45	5895
		648.45

The second case is thus : when you know the difference of the whole degree, and also the part proportional is known or allotted, to find thereby, to what centesim of the degree it answers. This is to be done by the converse of the former Rule, wherein you must work by Division, as before by Multiplication.

For as the whole difference	650
To one degree, or 100 parts	100
So the part of the difference allotted	585
To the centesim part of the degree	90

In this, the Table will help you as much as in the former ; for find your difference 650 in the last column of the Table, & looking along in that line, till you find your part proportional, or the nearest to it, which here is 585 ; this you shall find in the ninth column of the Table, therefore the part of the degree answering hereunto is either 9 tenths or 90 centesims of a degree.

If this Table were enlarged, it would do this business somewhat more exactly and readily, when you work in centesims of a degree. But as for decimal parts (which are as exact as you need) this part of the Table will do as well as all of it, though this Table would be of great use in Arithmetick, and much might be said thereof, yet I shall not enlarge upon it at present, but leave you sometimes to exercise your Multiplication and Division.





THE  
Advancement  
OF THE  
Art of Navigation,  
*The Second Part.*

Shewing several ways for the Regulating  
of the *Log-line*; for the more exact finding of the true  
Way of a Ship thereby.

With

Several other Conclusions propounded for  
this purpose; whereby the Minutes and Seconds of time  
may be exactly distinguished; and the constant motion of a  
Ship more certainly known, than by any other way used here-  
tofore.

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By HENRY PHILIPPES.

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T H E  
Advancement  
O F T H E  
Art of Navigation.

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*The Second Part.*

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**I**N the Practice of the Art of Navigation there is no one thing more necessary than to be able to make a true estimate of the way which the Ship makes with any Wind, according to the strength and continuance thereof; for this is one thing must still be known, by what Chart soever you keep the Account.

The best way in use for this purpose, is by the Log-line and minute glass, which though it be well known, and of good and ancient use among Sea-men; yet there are many things as to the manner of using thereof worthy consideration, which are not taken notice of by Sea-men, which would much help them in the true knowledge of their ships motion; And to this purpose I shall propound, First some things concerning the true length of the Log-line, and the ordinary use thereof by a minute glass, after the old way. Secondly, I shall propound somewhat concerning the exact measuring of the time without a glass, more exactly than by a glass, so that you shall not only know the first minutes of time, but the seconds, and half seconds thereof, by a most plain

Propositions about the Measuring of Time.

plain and easie conclusion as you can desire, and accordingly shall shew you how you shall use the Log-line, after somewhat a different and a better way. Thirdly, I shall propound unto you some CONCLUSIONS, which with Care and Diligence, may be brought to perfection; so that they shall shew the ships way much better than the Log-line, or any other way hitherto published.

To divide the Log-line to shew the 100 part of a degree.

For the first of these particulars. That which I would advise you about the length of the Log-line is this; That you make a knot at every 30 feet length of your line, and observe the running thereof by an half minute glasse, for then so many knots as veer out in half a minute, so many 100 parts of a degree the ship runs in an hour. So, that hereby you may readily account your ships way in degrees and hundred parts (which is best and most agreeable to these Maps) and so for any other number of hours, or for a day or two, as long as you see that force of wind and motion lasteth.

To mark the Log-line to shew the Miles or Minutes of a degree.

Or else if you have a mind to know the way of the ship in miles and leagues, or rather in minutes or 60 parts of a degree, then because there is in one whole degree 360000 feet, there will be in every minute or 60 part thereof 6000 feet. And therefore if you make a knot at every 50 feet length of your line, and use an half minute glasse; observe how many knots run out in half a minute, and so many miles or minutes doth the ship run every hour, and every 5 feet more, shews the tenth part of a mile over.

It is good for all to make use of the Log-line, or some other way.

Either of these wayes you will find much more exact then the old rule, of making a knot at every 42 feet or seven fathoms, which is grounded upon this erroneous principle, that there is onely 300000 feet in a degree, and so but 5000 feet in a minute or mile. It being proved by Mr. Norwoods experiment that there is about 367200 feet in a degree, though for the better conveniency of the divisions of the numbers and the line, and other good causes he takes but 360000 feet into the degree.

Now though this be the best way in use to find out the dead reckoning: yet some that would be accounted old experienced Sea-men think they can guesse well enough of the way the ship makes though they seldom or never use the

Log-

Log-line. It is true, experience may give a good guesse here- at : but to be the more sure, it is good to use all helps, and yet all little enough som time. Others they use to make some marks along the ships sides at a certain number of feet, and so letting any thing fall into the water at the head of the ship observe in what time it passeth by these marks, & so judge of the ships way. This way is subject to many exceptions, as first the dead water which the ship makes at her sides, causeth the motion of the thing that swims by to be too slow. Secondly the shortnesse of the measure of this motion, which can be but the ships length which is seldom an 100 feet. Thirdly, the shortnesse of the time of this motion, and the difficulty to know it exactly, yet because this way is better then none, and also because I shall shew you a good way for the true measuring not onely of minutes but seconds of time, I shall shew you how to place marks on your ship sides, whereby you may know the way your ship makes.

If you will reckon the ships way in miles or 60 parts of a degree, then measure 50 feet length upon the side of your ship and place two marks there: and if the ship run the distance of these two marks in halfe a minute or 30 seconds it is after the rate of one mile an hour. If the ship run these 50 feet in a quarter of a minute or 15 seconds, it is two miles an hour. If it run this distance in 10 seconds it is 3 mile an hour. If it run this distance in 6 seconds it is 5 miles an hour. If it run this distance in 5 seconds it is 6 mile an hour. If in 3 seconds it is 10 miles an hour.

To make two marks on the ship sides, to shew the way in minutes.

Or else if you make a row of marks along your ship side, making a mark at every twenty inches, then if your ship run one of these marks in a second, it is one mile an hour, If the ship run two of these parts in a second, it is two miles an hour: if three, it is three miles, if 5 it is five miles, &c. Or else if you divide the number of parts the ship runs, by the seconds of time, it shews how many miles a ship runs in an hour. Thus if the ship run 20 of these parts in 5 seconds, it is 4 miles an hour: if 20 in 4 seconds it is 5 miles an hour: if 20 in 2 seconds it is 10 miles an hour.

Another way by many short marks.

In like manner if you would reckon your ships way in hundred parts of a degree, then make your marks at 30 foot distance upon your ships sides, & if your ship be long enough you 100 parts

To make two marks on the ships sides to shew the way in 100 parts



you may make two or three of these marks 30 foot a sunder. So if your ship run one of these distances in half a minute, it is one 100 part of a degree in an hour: if 2 of them, it is 200 parts &c. Or else, if it run one of these distances in 30 seconds or half a minute, it is 100 parts of a degree an hour: if one in 15 seconds it is two hundred parts an hour; if one in 10 seconds, it is 300 parts an hour, and so always divide the half minute or 30 seconds, by the number of the marks of the ships motion, and the quotient shews the 100 parts of a degree run in the hour.

To find  
the same  
by many  
short  
marks.

Lastly, if you make marks at every foot upon the ship sides, then if the ship move one foot in a second of time, it is 100 parts an hour: if 2 feet or marks, it is 200 parts; if 5 feet or marks in a second of time, it is 500 parts an hour: Or as before divide the number of these feet or parts run, by the seconds of time, and the quotient shews the number of 100 parts, which the ship runs in an hour.

*The Second general head concerning the measuring of the time.*

Several  
uncertain  
ways  
which ma-  
ny use to  
estimate  
the time  
of a mi-  
nute by.

If you will know the true quantity of your ships way, you must not onely be carefull in dividing your line, but you must also be very exact in measuring the times: and not content your self as some do, to estimate the time by the pronouncing of a few words, or telling a certain number. As some think the saying of the Lords prayer, others that the telling of twice three score will take up a minute of time. But these ways are not only uncertain in respect of several men, some speaking slower, and some faster: but it will be an hard thing for one and the same man not to be ready to tell faster or slower, as he shall see the motion of any thing by him to be swifter or slower. Besides, a man may readily, and so be more apt to tell 1, 2, 3, 4, 5, &c. to ten or twenty, faster then 21, 22, &c. there being more time required to pronounce these double numbers, though his fancy may help him, if not other ways imployed.

*Kepler* observes that the pulse of a strong healthful man beats about 4000 strokes in an hour: which is 67 times in a minute. But Elderly and Melancholy mens pulses beat slower, about 60 times in a minute, whereas hot cholerick constitutions their pulses beat 80 times in a hour, neither doth

doth a mans Pulse beat all times alike, so that this is but an uncertain rule.

It is somewhat a better way to measure these small moments of time by walking a certain number of steps or strides. Thus a man walking a good handsome pace, viz. after the rate of 3 English measured miles, or two and a half of ordinary country miles an hour, doth take 120, or twice three score steps in a minute of an hour, which is two steps in every second. For thus the head and foot being both in action, the motion of feet being alwayes equal, will keep the tongue from running too fast in those lesser single numbers, and so the more senses being exercised about this, they will one help the other.

But the best way hitherto used for this purpose is a good glass made to run a just minute, or half a minute, or 36 secants which is the hundreth part of an hour according as you please your self, and as your line is fitted with knots. Against this, if it be well and truly made, I have little or nothing to except: But yet these glasses shew onely the time they run for, whether it be a minute or half a minute, and give no good notice of the seconds or smaller moments of the time, which may in many cases be of good use, as I shall give some instances anon.

And because you cannot be too carefull in measuring these small parcels of time, since a small error in a minutes time will come to much in 60 minutes which is but one hour, and much more in a day or a longer time: therefore I shall shew you two or three ways which may easily be brought into use, which will be very exact for the measuring, not only of those minutes, but also of their seconds.

The first way may be by a watch or clock, either a small pocket watch, or those greater, or lesser brass clocks, which go by weights, either of these may be so contrived by a good workman, that they may by little hands or Indices shew the minutes and seconds, as well as the hours: and some such I have seen made, and the like may be easily performed in others. For generally the ballance wheel of a great brass clock, which goes by weights turn about in a minute of an hour: And some of the lesser size, their ballance wheel turns about twice in an hour. But because this wheel goes as it were by steps

To find  
the time  
of a mi-  
nute by a  
Watch or  
Clock.

steps and starts, it will much better be performed in a pocket watch, if the cantrite wheel be fitted so as to turn about in a minute, this may have a little Index and circle fitted to it, which will shew the seconds very handsomely and truly.

But if you think this may be too chargeable to have watches made on purpose, you may do the like by any ordinary watch, if you bestow the reckoning of the teeth of the wheels, and so find how they are moved one by another. Thus in an ordinary watch which hath four wheels, and the pinions 5 leaves or teeth. There is 1 the ballance wheel, whose pinion hath 5 leaves, this is turned by the cantrite or crown wheel, which hath 40 teeth so that if you divide 40 by 5, you shall find this wheel at each turning turns the ballance wheel 8 times about. Then there is the second wheel, which hath 45 teeth: this therefore turns about the crown wheel 9 times. Lastly, there is the great wheel, and this hath 55 teeth, so that this turns about the second wheel 11 times. Now if you multiply these one by the other.

The ballance wheel	1	} times.
The Cantrite wheel turns this 8 times	8	
The second wheel turns the Cantrite 9 times.	9	
Which being multiplyed together, is	72	
The great wheel turns this 11 times	11	} times.
By which multiply the other, it makes	792	

So that the great wheel by once turning about, turns about the ballance wheel 792 times.

Now this great wheel usually hath a pinion of 4 and the hour-wheel hath 36 teeth; so that it turns about 9 times in 12 hours, and so brings the hand of the watch round about, in which 12 hours there is 720 min. which divided by 9, shews this great wheel turns about just in 80 minutes: divide therefore the foresaid 792 turns of the ballance wheel by these 80 minutes of time, and you shall find 9.90. so that the ballance wheel turns about 9 times and 90 hundred parts in a minute of an hour.

But this coming so neer to 10 times, you may account 10 turns of the ballance wheel to a minute, and so every turn of the ballance-wheel is 6 seconds.

But

But it being too troublesome to stand poring upon the swift motion of the ballance wheel, and so to keep count of the ten revolutions; you see before that the cantrite wheel turns the ballance-wheel 8 times about, so that this cantrite wheel is 8 times 6 seconds, or 48 seconds in turning about. Therefore if you make a mark upon the ballance wheel, and another upon the cantrite wheel, you shall know that when these marks comes to a certain place together, that the ballance wheel is turned about 8 times, and then twice more makes up the minute.

Or else, if you set first one mark upon the cantrite wheel, and then set two other marks by it; the one ten teeth before it, and the other ten teeth after it; the one of these will shew six bouts of the ballance wheel, which is 36 minutes, which is the 100 part of an hour, and the latter will shew the minute, or 60 part of an hour.

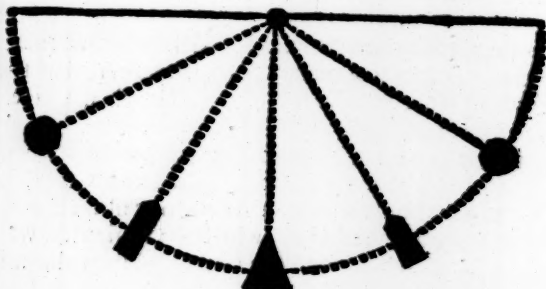
In these conclusions it will be best to mark both the ballance wheel, and the cantrite wheel, (which you may do when your watch is in pieces with a little graver, or if you please with your pen, and a little ink) for both wheels being thus marked, the mark upon the ballance wheel coming to your eye will more exactly shew the true revolution of either wheel, and the marks upon the other will give you better notice of the number of the bouts of the ballance wheel, and when the minute is up.

To conclude this conclusion, though all watches are not made with these numbers of teeth, but some have six leaves in a pinion, and some difference also may be in the number of the teeth of the wheels, yet you may by this Example know how to find out the like by any other watch, and so by two marks upon the cantrite and ballance wheel, find the true time of a minute, or half a minute or, 36 seconds which is the hundred part of an hour, or any other small proportion of time you desire.

But the most easie and exact way for the measuring of these small parcels of time, is by hanging a good big bullet or a plummet in a string, the string being fitted to a just length, and fixed handiely to the top of any Room, or any timber of the ship, and so telling the swings thereof. And this will prove no childish conclusion, as it may seem at the first, but  
 § I  
 may exactly.

A new experiment by the swinging of a plummet, to know any small part of time.

See *Gali-* may be made good use of in many things, and will be most  
*leus* his Di- easie and exact in the performance, if you consider these  
 alogues, experiments about it.  
 and *Digby*,  
 of Bodies.



First thing First, it may be proved by demonstration, but more easily  
 observable by experience, that a bullet or plummet hung in a string, and  
 in this. being moved gently from the Perpendicular to any angle,  
 The same (keeping the string straight) and so let go to have its own  
 number of swing, will keep such exact time in its swinging, that though  
 swings it fetcheth a greater compass at the first swinging thereof,  
 first and yet it keeps the same time in the same number of swings.  
 last, are So that if it make 20, 40, or 60 swings in a minute at the first  
 made in motion, it will do the like afterward, until it stands quite  
 the same still. And if you will have an easie experiment to prove this,  
 space of take 2 bullets of like weight, & let them hang in the strings  
 time. of like length, let these two bullets be drawn from their  
 perpendiculars to an equal angle, and both let go together,  
 you shall find them keep the same time and motion together  
 for a long time, if the strings be just of equal length.

An easie But now to try whether they keep the same time also of  
 proof that their first and last motion; do thus. When the one of them  
 the swings hath swong a good while, then lift up the other to a conve-  
 keep equal time. nient height, so as the first was before, and so let it go of it  
 self; & though this plummet last let fall will fetch a greater  
 compass then the other, yet you shall find them keep a just  
 number



number in their swings, so that the one shall get of the other little or nothing, if the length of strings and all else be equal. This is a plain and undeniable proof, that the like number of swings first and last of any plummet are in equal time.

But secondly, if I should allow you a greater latitude in this experiment, as that you should take bullets or plummets of several bignesses and weights; yea of several forms, yet the experiment will be much the same, and the number of swings will be equal in the equal time, if the length of the strings be equal. \* Only in this case, you must not measure the bare length of the string, but measure from the center of gravity of the bullet or plummet, to the place where the string is fastened above: and thus doing, though a round bullet may seem best, yet any form of the plummet will do the like. And this rule must be observed also in the hanging of bells in Churches, that though the bells are of different sizes and weights, yet they must all so hang, that there may be the like space from the Axle-tree pin, or center of the motion, to the center of gravity of the bell: else the bells will never keep time: and the nearer they are thus hung, of equal length, in respect of their center of gravity, the better they will keep time, and ring the truer with less trouble. This you may try likewise, as before with two different plummets, and you will find the number of swings equal; yea, though ye do not lift them up to the same angle from the perpendicular, but the one to 30 or 40 degrees, the other to 60 or 70 degrees.

Thirdly, here is nothing thereof necessary to this purpose, which you need be curious about, but onely to know how long the string must be, from the center of gravity of the bullet or plummet, to the point where the line is fixed, that so it may make a certain and desired number of swings in a certain and determined time, viz. in a minute, or half a minute, or the hundred part of an hour. And to this purpose I have found, that if the string (as aforesaid, reckoning to the center of the plummet) be 38 inches and an half, then the plummet will make 60 swings in a minute of an hour, reckoning the swings both forward and backward into the number. And of this also you may as easily make trial your self, either for this, or any other length of time, which you desire.

2dly. That the difference of weights, either in respect of quantity or form, do not alter the motion.

\* Mark this well in the measuring of the string, to the center of gravity let the plummet be of what form it will.

3dly. All the care is to be had in the length of the string, which is soon found, and is always constant.



4thly. You may so order the length of the string either by observation or calculation, to make any number of swings in any time desired.

4thly, Likewise if you desire to have more or fewer swings in this time, or any other like parcel of time, you may find it out by lengthening or shortning the string, observing this rule (which you will quickly find) that if you lengthen the string, the number of swings will be fewer; but if you shorten the string, the number of swings will be more.

And herein that I may not leave you to run at randome, when there is a good rule to go by, which also proves the conclusion to be more considerable and Mathematical, you may take notice, that the number of swings have a Quadratical proportion to the length of the string reckoning, as I said before, the shorter the string, the more the swings and the longer the string, the fewer the swings, and therefore you must work by the back rule of proportion to find out the length of the string.

*For Example.*

If 38 inches and an half make 60 swings in a minute of an hour, how many will 77 inches (which is double this length) make in the same time ?

Inches 38.5	Swings 60	Inches 77.0	Swings 42.4
	Square 60		
	<hr/> 3600		Square 1800

Here if you square the 60 swings, they make 3600, by which multiply the first number, 38.5 inches, the product makes 1386000 then divide this product by the third number 770 & the quotient is 1800. Lastly, find the square root of this 1800, and it is 42.4. which shews, if the string be 77 inches, the plummet will make 42 swings, and almost an half.

And thus you may it find, if you try by the string.

Again, if you would proportion the number of swings to any time; as if you would have the plummet make 120 swings in a minute of an hour, the manner of work will be the same, as in this example.

60 Swings

60 Swings.	38.5 Inches.	120 Swings.	9.625 Inches
Squ. 60	3600.	Squ. 120	
3600	231000	2400	
	1175	120	1386000 (9.625
	1386000	14400	14400

Here if you square the 60 swings, they produce 3600 which multiplied by 38.5. inches, make 1386000, as before; then square the 120 swings, and they make 14400; by which divide the former product, and the quotient will be 9 inches, and 625 thousand parts of an inch.

If you have a mind to alter this conclusion to any other number of swings in a minute, you may see by this how to do it. If you would know how many of these swings go to any other part of time, it is more easie being done by the rule of plain proportion. Thus according to the first length,

If one minute | hath 60 | Then 36 seconds or | hath 36  
or 60 seconds | Swings | the 100. part of an hour | Swings,

But I think there will be no need to do this, but you may be content with the first propounded length and time, which is 35 inches and an half, making 60 swing in a minute of an hour, which answers very well to the 60 seconds which are in a minute, of which there are 3600 in an hour; This length of the string is very convenient, and the Plummets will swing a longer time than if the line be shorter, and it will require a good handsome weight of a pound, or half a pound at least, which will not be so subject to be hindred by the wind as a lesser may. Yet for a curious trial of a small time, you may make use of the shorter length, 9 inches, 625 thousand parts, this passing by the Perpendicular line, 120 in a minute makes a distinction not only of the seconds, but of the thirds also, there being two swings to each second, and this in a close place, fitted with an handsome bullet, and a gentle silk string, will swing a good while. And if you find the motion begin to fail, you may help it with a gentle touch of your hand

had, and so make it stronger again. So I leave you to your own choice.

An Objection in respect of the unsteadiness of the Ship. There is onely one thing that may be objected as doubtful in the Practice of this conclusion: and that is, least the shaking and rousing of the ship, should hinder the motion of the Plummets. And indeed such is the nature of this motion, that nothing disturbs it more then an unconstant or disorderly shaking thereof; as you may see by this easie proof.

The Inconvenience not only granted, but proved by tryal. Take two strings of an equal length and plummets of equal length and weight, let them be both 38 inches  $\frac{1}{2}$ , or any other length you please, let the one of them be made fast to the top of a room, and hold the other in your hand, holding your hand as steady as you can; let these two plummets begin to swing both at one time, mounted to the same angle; yet that which you hold in your hand will go somewhat slower then that which is fixed; because you cannot (or very hardly) hold your hand so still, but that the motion of your hand will alter the swinging of the plummet very sensibly, so that it will neither swing so fast, nor so long, as that which is fixed. Yea, the more you move your hand, thinking to make it go the faster, it will go so much the slower; and if you move your hand too fast, thinking to force it beyond its own natural motion; it will not swing at all.

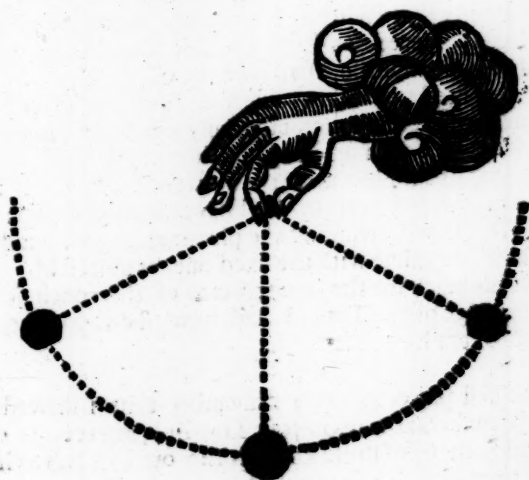
How to prevent this inconvenience with a plain proof and tryal thereof. But to prevent this inconvenience, I shall shew you how to order this conclusion another way, so that you shall not need to fix your line to any part of the ship, but hold it in your hand; and thus if the Sea be not too much overgrown, but that you may stand handsomely upright in your ship, you may by the swinging of the plummet find these small moments of time as exactly as in a clam, or in a house upon the land.

The length of a minute line for 60 swings in a minute is 31 inches and a half. And to this purpose, because the plummet held in the hand is subject to swing slower than the other, therefore the line must be somewhat the shorter, which by tryal I find must be 31 Inches and an half.

Thus you may easily try your self; For take one plummet with a string of 38 inches  $\frac{1}{2}$ , and fix it to the top of a Room; and take another plummet, and make the string thereof 31 inches  $\frac{1}{2}$ , measuring from the Center of gravity of the plummet

met, and tying a knot at the end of the length (which may be as a mark to know where to hold it, also help you in the holding thereof) hold this string by this knot between the ends of your thumb and fore-finger, making it swing as fast as handfomely you can, without disturbing of the motion, either by too much, or too fast moving of your hand, only with a gentle motion of your hand make the plummet mount always as near as you can to the same height, so that it may make an angle of 50 or 60 degrees with the perpendicular; and thus doing you shall find these two plummets (though the strings differ thus much) to make an equal number of swings in the like space of time; so that you cannot well make this in your hand swing faster nor slower than that which is fixed, but either of them will make just 60 swings in a minute of an hour.

You must not swing your arm to and fro, only with a gentle moving of your hand make the Plummet always as near as you can, swing to the same height.



In like manner, whereas the shorter fixed string was ordered before to be 9 inches 625 parts, making it 8 inches and long, and tying a knot at the end thereof; if you hold this neatly between the end of your thumb and fore-finger, and make it swing so that it may mount at each swing to

The length of a minute line for 120 swings in a minute is 8 inches and about a quarter.

about an angle of 50 or 60 degrees, you shall find they will both alike make 120 swings in a minute of an hour; and so shew you not onely the seconds but every half second of time very exactly.

The conclusion of this experiment, shewing the best way for the practice here of.

Thus this experiment will be most easie and ready upon all occasions, So that this will be the very best way for the Sea-mans practice, for having thus once fitted his Minute line (as I may call it) and made a knot at the end thereof, as a constant mark where to hold it; he may carry it to any Place of the ship where he hath occasion to make observation of the Ships way; and hold it in his hand as well as his glass. And hereby also having his sense of feeling, as well as his sight he may much more easily and certainly count the number of the swings, according as by occasion they shall be more or less, which may sometimes be 100 or 200, while the line is in running out; and the longer the time is, so much more certainly there will be of the observation, so that by this means you need not stint your self to a minute, or half a minute as you must do, if you use the Glass.

Neither need you fear that any ordinary wind will alter the motion of the plummet, especially if it be of a considerable weight, viz. half a pound, or thereabout: neither will the swaying of the Ship alter the motion, if it be not in some great extremity of weather, for I have tried that you may walk up and down, swinging the plummet in your hand, and yet it shall keep time with the fixed one, as aforesaid.

And thus much for the contrivance of this conclusion for the knowledge of the Time, I shall now shew you how to make use of the Line therewith.

How to make use of this conclusion with the ordinary Log-line.

In the first place, you may remember that I shewed you before to make knots upon your Log-line, at every 30 or 50 feet, and so many of those knots run out in a half minute, so many 100 parts, or so many 60 parts of a degree your ship runs in an hour. Now here you see that 30 swings of the longer plummet, or 60 swings of the shorter plummet, are half a minute, which I presume you will find more exact and constant, then most glasses are or can be, and so you may make use of this conclusion instead of a glass, yea, you may make, or try your glass hereby, whether it be true or not.

But



But secondly, by this way you have not only knowledge of the just period of each minute, or half a minute, but of every second, or half second, which you may thus farther improve. For if you have a mind to set marks on your Ship sides, as I shewed before four several wayes; all of which depend upon the knowledg of seconds of time, which a glasse cannot shew you, these swings being not only to every second, but (if you use the shorter string) to every half second, will shew those small moments of time so exactly, that hereby you may come to a far greater certainty of your ships way, than if you should measure the time, either by words, numbers, steps, or pulses, or any other way formerly thought of.

How to make use of this conclusion, with the ordinary marks upon the Ships side.

But 3dly & lastly, if you will keep a good account of your ships way it will be needful to order your line so, that you may always let as much line run out, as you can with convenience of drawing it in again without fear of breaking. Now the faster your ship runs, so much the more line will you veer out at one time than at an other, and also so much the more danger there is of breaking your line (when it runs out too far and too fast.) Therefore it will be the best, not to stint yourself to a certain space of time; (as you must do if you use the glasse) but rather to make your line of a good convenient length, and let the line alwayes run out this full length, and there stop, and so observe the minutes and seconds of the time, which the line is running out; or (which is all one) the number of these swings of the plummets.

A new way of ordering the Log-line.

Now to this purpose, if you have a mind to reckon your Ships way in miles, or 60 parts of a degree, each mile hath 6000 feet (according to Mr. Norwoods Experiment and direction) now the tenth part of this is 600 feet, or 100 fathoms. This may be a very fit length for your line. If the length run out in six minutes, then the ship runs one mile an hour. If this length run out three minutes, it is two miles an hour; if in two minutes, it is three miles an hour.

To know the Ships way in miles or minutes of a degree.

For,

As	{	6 min. to 60 min.	{	$\frac{2}{10}$	to	$\frac{1}{10}$	or one mile.			
		3 min. to 60 min.						$\frac{2}{10}$	$\frac{2}{10}$	or two miles.
		2 min. to 60 min.						$\frac{2}{10}$	$\frac{1}{10}$	or three miles

And



And so for any other number of minutes. But this will be much more exact, if you reckon the running of the line not by whole min. but by seconds or fwings; for the ship will not alwayes run this length in just even minutes of time, neither will the hourly motion of the Ship fall out alwayes in equal miles, or min. of a degree, and these fractions will be more easily reduced, and your work somewhat more exactly performed, if you account the Ships way in miles, and hundred parts of a mile, rather than in miles and 60 parts.

Thus if the Ship runs the length of your line, being 600 feet, in 48 seconds of time, or 48 fwings of the longer plummet, it is 7 miles 50 parts, or 7 miles and an half in a hour. If it run these 600 feet in one minute, 20 seconds, or 80 fwings, it is 4. 50, viz. 4 miles and an half in an hour.

For,

As  $\begin{cases} 48'' \\ 80'' \end{cases}$ , to 3600'': So 600 feet, or  $\frac{25}{16}$  of a mile, to 750.  
 As  $\begin{cases} 48'' \\ 80'' \end{cases}$ , to 3600'': So 600 feet, or  $\frac{3}{8}$  of a mile, to 450.

This work is very easie, you need but divide 3600, the seconds of an hour, by the seconds in which the line is veering out, and the quotient shews the ships way in miles and ten parts: and if you add one place more, making your dividend 3600, the quotient will shew you the miles and hundred parts.

## A Table

A Table shewing the way which a Ship makes, according to the minutes and Seconds of Time, in which the Log-line is in running out, either in minutes, or hundred parts of a degree, according to the different length of the Log-line, either 60, or 360 feet.

Time.	Ships way	Time.	Ships way	Time.	Ships way	Time.	Ships way
/ //	miles pts.	/ //	miles pts.	/ //	miles pts.	/ //	miles pts.
0 10	36 00	0 40	9 00	1 10	5 14	1 40	3 60
11	32 73	41	8 78	11	5 07	41	3 56
12	30 00	42	8 57	12	5 00	42	3 52
13	27 69	43	8 37	13	4 93	43	3 48
14	25 71	44	8 18	14	4 86	44	3 45
15	24 00	45	8 00	15	4 80	45	3 42
16	22 50	46	7 83	16	4 74	46	3 39
17	21 18	47	7 66	17	4 68	47	3 36
18	20 00	48	7 55	18	4 62	48	3 33
19	18 95	49	7 35	19	4 56	49	3 30
20	18 00	50	7 20	20	4 50	50	3 27
21	17 14	51	7 06	21	4 45	51	3 24
22	16 36	52	6 92	22	4 40	52	3 21
23	15 65	53	6 79	23	4 35	53	3 18
24	15 00	54	6 67	24	4 30	54	3 15
25	14 40	55	6 55	25	4 25	55	3 12
26	13 85	56	6 43	26	4 20	56	3 10
27	13 33	57	6 32	27	4 15	57	3 07
28	12 86	58	6 21	28	4 10	58	3 05
29	12 41	59	6 10	29	4 05	59	3 03
30	12 00	1 00	6 00	30	4 00	2 00	3 00
31	11 61	01	5 90	31	3 96	01	2 97
32	11 25	02	5 81	32	3 92	02	2 95
33	10 91	03	5 72	33	3 88	03	2 93
34	10 59	04	5 63	34	3 84	04	2 90
35	10 28	05	5 54	35	3 80	05	2 88
36	10 00	06	5 45	36	3 76	06	2 86
37	9 72	07	5 37	37	3 72	07	2 84
38	9 47	08	5 29	38	3 68	08	2 82
0 39	9 23	1 09	5 21	1 39	3 64	2 09	2 80

*Note, if the Log-line be 600 feet long, then the Table shews the minutes and parts of a Degree, each mile being 6000 feet, and 60 miles in one degree. But if the line be 360 feet long, then the Table shews the hundred parts of a degree, and their lesser hundred parts.*

Time.	Ships way	Time.	Ships way	Time.	Ships way	Time.	Ships way
/ //	miles pts.	/ //	miles pts.	/ //	miles pts.	/ //	miles pts.
2 10	2 77	2 50	2 12	4 00	1 50	6 00	1 00
11	2 75	52	2 09	03	1 48	60	0 98
12	2 73	54	2 07	06	1 45	12	0 96
13	2 71	56	2 05	09	1 45	18	0 95
14	2 69	58	2 02	12	1 43	14	0 93
15	2 67	3 00	2 00	15	1 41	30	0 92
16	2 65	02	1 98	18	1 40	36	0 90
17	2 63	04	1 96	20	1 38	42	0 89
18	2 61	06	1 94	24	1 36	48	0 88
19	2 59	08	1 92	27	1 34	54	0 87
20	2 57	10	1 90	30	1 33	7 00	0 86
21	2 55	12	1 88	33	1 31	12	0 83
22	2 53	14	1 86	36	1 30	24	0 81
23	2 51	16	1 84	39	1 28	36	0 79
24	2 50	18	1 82	42	1 27	48	0 77
25	2 48	20	1 80	45	1 26	8 00	0 75
26	2 46	22	1 78	48	1 25	12	0 73
27	2 45	24	1 76	51	1 23	24	0 71
28	2 43	26	1 74	54	1 22	36	0 70
29	2 41	28	1 72	57	1 21	48	0 68
30	2 40	30	1 70	5 00	1 20	9 00	0 67
32	2 37	33	1 68	06	1 18	12	0 65
34	2 34	36	1 67	12	1 16	24	0 64
36	2 32	39	1 65	18	1 14	36	0 63
38	2 29	42	1 63	24	1 12	48	0 61
40	2 25	45	1 60	30	1 10	10 00	0 60
42	2 23	48	1 58	36	1 08	10 30	0 57
44	2 20	51	1 56	42	1 06	11 00	0 54
46	2 17	54	1 54	48	1 04	11 30	0 52
2 48	2 14	3 57	1 52	54	1 02	12 00	0 50

But

But because I would make things as plain and ready as I can, I have calculated this foregoing Table, shewing you the ships way, according to this length of your line, (*viz.* 600 feet, or the tenth part of a mile) for minutes and seconds, even to every second, where there is any need. So that finding the number of seconds in which the Ship is running this length of your line in the Table, there you shall find the Ships way ready cast up to your hand in miles and hundred parts for one hour. And having the way for one hour, you may by Multiplication or Addition soon find the way your ship makes in 4, 8, 12 hours, or a whole day, or any other time desired.

This Table you will find very needful to save you much labour, and to prevent mistakes.

Once more, if you will reckon your Ships way in hundred parts of a degree, then there being 3600 feet in one hundred part, the tenth part of this is 360. And so if you make your line 360 feet long, and observe how long the ship is in running this length, and work as before, making use of this Table, (which serves for both) so you shall find the way the ship makes in hundred parts of degrees, and their hundred parts; which will be the most exact way of account, and very ready to be set off upon your Maps and Charts, being for the most part graduated in Decimals.

How to fit the Log-line after this new way, to shew the 100 parts of a degree and their parts.

And this is somewhat the better way also, because your line need not be so long, as if you reckon in 60 parts or miles.

Last of all, If you have a desire to make marks by your ship sides. Then if you will reckon by an hundred parts of a degree, make your two marks 36 foot asunder: Or if you will reckon in 60 parts of a degree, *viz.* miles, make your two marks 60 foot distant; and so you may reckon the Ships way by this following Table.

To perform the same by marks upon the ship's side.

## A Table

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*A Table shewing the way which a Ship makes, according to the Seconds of Time, in which any little thing swims by her side, between two marks placed thereon, either in minutes or hundred parts of a degree, according to the distance of the marks, being either 60, or 36 feet asunder.*

<i>Time.</i> ' "	<i>Ships way</i> miles pts.	<i>Time.</i> ' "	<i>Ships way</i> miles pts.	<i>Time.</i> ' "	<i>Ships way</i> miles pts.
0 30	72 00	10 30	3 42	23 00	1 56
1 00	36 00	11 00	3 27	24 00	1 50
1 30	24 00	11 30	3 12	25 00	1 44
2 00	18 00	12 00	3 00	26 00	1 38
2 30	14 40	12 30	2 88	27 00	1 33
3 00	12 00	13 00	2 77	28 00	1 29
3 30	10 28	13 30	2 67	29 00	1 24
4 00	09 00	14 00	2 57	30 00	1 20
4 30	08 00	14 30	2 48	31 00	1 16
5 00	07 20	15 00	2 40	32 00	1 13
5 30	06 55	15 30	2 33	33 00	1 09
6 00	06 00	16 00	2 25	34 00	1 06
6 30	05 54	16 30	2 18	35 00	1 03
7 00	05 14	17 00	2 12	36 00	1 00
7 30	04 80	17 30	2 06	40 00	0 90
8 00	04 50	18 00	2 00	45 00	0 80
8 30	04 25	19 00	1 89	51 00	0 70
9 00	04 00	20 00	1 80	60 00	0 60
9 30	03 80	21 00	1 71	72 00	0 50
10 00	03 60	22 00	1 64		

And

And because these lines and distances are very short, you will do best to observe the time by the shorter plummet of 9 inches 625 parts, so you shall have two swings for every second of time which will make your observation so much the more exact.

And if this way be carefully observed, it will be as exact as any other that hath been used hitherto. All that can be said against it, is : First, the shortness of the distance. Secondly, dead water by the Ships sides, which is caused by the motion of the Ship. The first of these, the shortness of the distance, this is recompenced by the exact account of the time, which may be found by this experiment to the half part of a second. As for the dead water by the Ship sides ; this the line is also subject to in some sort, though not so much : as you may perceive by the eddy and stillness of the water, a good way after a Boat or Ship, which you must be careful in some sort to allow for, when you use the line.

And therefore, when I direct you to have your line 360, or 600 feet long, you must not understand this to be the length of your line to be reckoned from the very Log. But first you must take so much line, as may let your Log float a good way from the ship, that so it may be out of the eddy and dead water of the Ship ; and here you must place your first knot or mark, which you must hold in your hand, and let it go when you begin to count your minutes or seconds, and from this knot you must account the said number of feet you desire.

Caution  
how to  
order the  
Line in  
time of  
Observa-  
tion.

There will be also another inconveniency, when your line is long, which ought to be taken care of, and that is, that your line will be subject to sink in the water, and so not to veer out straight. For it having no steady hold at the Log, and you being careful not to over-hale the log, and so bring it after you, the line will be subject to sink, and so to veer out too fast.

Make  
some tryal  
how to  
prevent  
the sink-  
ing of  
your line.

To prevent this, you must be careful to keep your line as dry as you can, or to use some means to make it swim upon the top of the water ; which, whither it be done best by oiling or tallowing, or tarring, I leave it to your experience : And it were not amiss, if you put little corks here and there upon





upon the line, to make it swim, if they can be so ordered; that they may not hinder the running of it out.

And thus you have the best way in use for the finding of the Ships way, which I have improved the best wayes I can so that I doubt not but you will find some of these things worthy your trial and practice, both in the ordering of your line, and in your observation of the time. But yet for all this, both of them will be so short, that a small error in either of them will amount to much in an hour, and more in longer time.

The best comfort is, that you are not alwayes forced to trust to this way of account. For when you make any considerable alteration of Latitude in your course, you may by observation thereof correct your errors herein, and by observing how these rules agree with such courses, you will know the better how to judge of them, and to use them for the future.

FINIS.

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